

THE FORESTRY CONDITIONS
AND
SYLVICULTURAL PROSPECTS
OF THE
COASTAL PLAIN OF NEW JERSEY
WITH
REMARKS IN REFERENCE TO OTHER REGIONS.

INAUGURAL-DISSERTATION
ZUR
ERLANGUNG DER DOKTORWÜRDE
DER
HOHEN STAATSWIRTSCHAFTLICHEN FAKULTÄT
DER
KGL. BAYER. LUDWIG-MAXIMILIANS-UNIVERSITÄT
ZU MÜNCHEN
BY
JOHN GIFFORD.

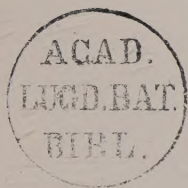
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Introduction.

I have selected this subject for two reasons: first, owing to favorable climate, location, transportation facilities and cheapness of land the Coastal Plain of New Jersey is, in the near future, surely destined to be exploited and developed. When one considers that the value of farmland in New Jersey is higher than that of any other state in the Union, one irresistably concludes that the future is full of promise for those lands which are fit only for forest. Second, I am deeply interested in its welfare and have been endeavoring, in a small way to demonstrate by experiment the possibilities of a piece of barren sandy land.

I wish to express my gratitude to Prof. Dr. H. Mayr, the author of an excellent book on the forests of America, for his friendliness and help, a feeling which is shared by every American who comes to the University of Munich to study Forestry.

John Gifford,

Permanent Address
Princeton, N. J. U. S. A.

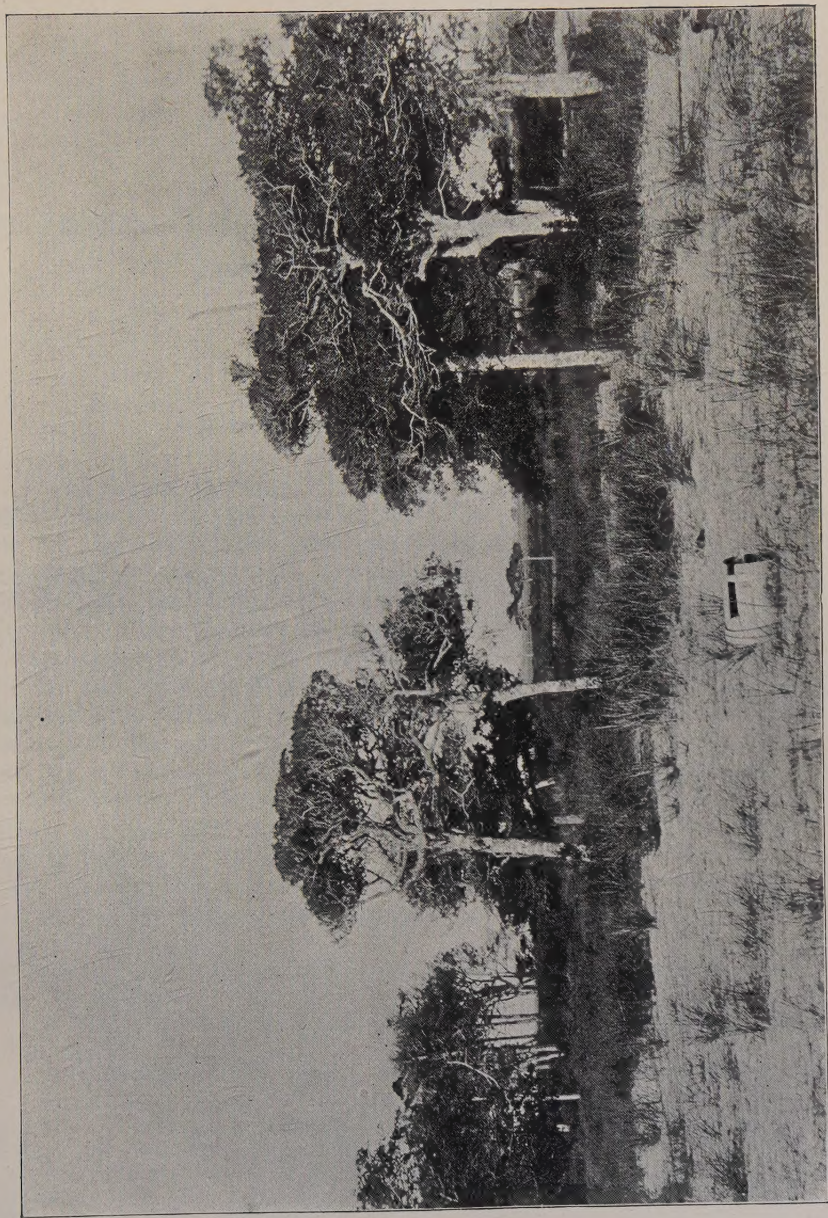


Plate I. A group of hollies (*Ilex opaca*) on Seven-Mile Beach. In such places there are no dunes because the vegetation is not dense enough to prevent the westwind from blowing back the sand. This picture shows well the whiteness of the trunks, the flatness of the crowns and the irregular, jagged nature of the limbs and twigs.

The Forestry Conditions and Sylvicultural Prospects of the Coastal Plain of New Jersey.

Chapter I. General Description.

The region to which this title refers is located in the south-eastern portion of the state of New Jersey, less than one hours ride by train from New York and Philadelphia.¹ It is irregularly triangular in shape, and is included between latitudes 40° 20' and 38° 55', and longitudes 74° and 75° 30'.² It is the northern extremity of the Atlantic Coastal Plain, which extends southward in vast stretches of sandy pine and swamplands, to the cocoanut groves, and pine apple fields of Southern Florida. The Coastal Plain of New Jersey is bounded on the southeast by the Atlantic Ocean; on the southwest by Delaware Bay, and on the north-west by a comparatively thickly populated and productive agricultural region. The area of this territory is about 2500 square miles³, at least seventy five per cent of which is woods.⁴ It is slightly rolling in nature, seldom exceeding two hundred feet above the level of the sea, and is traversed by several navigable rivers⁵ besides many small streams.

Location,
Area, and
Altitude.

Boundaries.

¹) The combined population of adjacent cities amounts to more than five million.

Population
of Adjacent
cities.

²) This region lies in about the latitude of Naples, Constantinople and N. Japan.

Latitude.

³) One square mile equals twohundred and fifty nine hectares.

A square mile
in hectares.

⁴) The term "forest" is seldom used by the natives. Good or bad, big trees or bushes, it is all called "woods" which is a good generic name for such non-de-script lands. The word "forst" from which comes forest is a pure Germanic word. From the earliest times it has been applied to woods which have been protected and regulated. See note in Forst Politik by Dr. Adam Swappach.

The term
"woods".

⁵) It is easy to secure an abundance of water in this region. A copious natural flow of water may be obtained from Artesian wells, so that in places irrigation is easy and practical. Several wells less than

Artesian
wells.

Life zone and
Climatic
Conditions.

The East American life zones, each characterized by certain forms of life, extend westward with exceedingly irregular and broken borders. There is a transition belt in which the North and the South more or less overlap. This is the true agricultural part of Eastern North America, where apples, white potatoes, barley and oats attain their highest development. It is where the oak, hickory, chestnut, liquidamber etc. of the south, meet the maple, beech, birch, hemlock, tamarack and arbor-vitae of the north. South of this transition belt begins the first of the true Southern zones, the Carolinian, to which the Coastal Plain of New Jersey belongs.¹

The Carolin-
ian Zone.

A very large percentage of this zone is, and is likely to remain in forest. It is characterized by the sassafras, persimmon, liquidamber, magnolia (*M. glauca*) the tulip-tree etc., and by the gray fox, cardinal bird, opossum² etc. It is the zone of the peach, apricot, tobacco, the Concord, Isabella and Catawba grapes³, the chestnut, English walnut⁴, and sweet potato. On its southern borders the long-leaf-pine (*P. palustris*), the old-

two-hundred feet in depth flow constantly and copiously. The term Artesian is applied in America to any deep well even when pumping is necessary to elevate the water.

The special
advantage of
a northern
Extension of
a Southern
zone or vice
versa.

¹) The Coastal Plain of New Jersey is a northern extension of the Carolinian belt into the Transition Zone. It is in reality a part of the South in the North and as Prof. Merriam says: "When such arms occupy suitable soils in thickly inhabited regions, so their products may be conveniently marketed, they are of more than ordinary value, for the greater the distance from its area of principal production a crop can be made to succeed, the higher price it will command. Hence, farms favorably situated in northern prolongations or islands of southern zones, or vice versa, should be worth considerably more per acre than those situated within normal parts of the same zones. The obvious reason is that by growing particular crops at points remote from the usual sources of supply, and at the sametime conveniently near a market, the cost of transportation is greatly reduced and the profit correspondingly increased".

The
Opossum
and Coon.

²) The opossum (*Didelphys Virginiana*) about which so much has been written because of its marsupial pouch and peculiar habit of feigning death, is arboreal in habit, with handlike feet and prehensile tail, and is fond of the fruits of the persimmon tree, the seeds of which it is instrumental in distributing. It is highly esteemed as food especially by the negroes of the South. Another very popular American animal is the coon or raccoon (*Procyon lotor*).

The wild
Grape.
And its Cul-
tivated
Forms.

³) The Concord, Isabella and Catawba varieties are cultivated forms of *Vitis Labrusca*, the fox-grape, which is abundant in the Swamps of New Jersey. The Southern fox grape, muscadine or bullace is *Vitis rotundifolia*, a cultivated variety of which is the Scuppernong. This grape is rare north of Virginia.

The Persian
Walnut.

⁴) East of the Rocky mountains the English or Persian walnut has been most successful in a limitid area along the Atlantic Coast from New York southward through New Jersey, Southeastern Pennsylvania, Central Virginia, North Carolina and Georgia. Farther South it does not succeed owing mainly to the depredations of microscopic worms which cause a disease commonly known as „root-knot“.

field-pine (*P. Taeda*)¹, the bald cypress (*Taxodium distichum*), and the southern magnolias appear. No tree is more characteristic of the Carolinian zone than the short-leaf-pine (*Pinus echinata*), and although it reaches its optimum in Arkansas and Missouri, it is perfectly at home in Southern New Jersey.

Owing to its nearness to the Ocean, the warmth of its silicious soil, and its slight elevation above the sea level, the climate of the Coastal Plain of New Jersey is mild and moist. The winter of 1894—95 was a cold one. During that time I noted the temperature² twice daily at a place in its central part, as follows:

Climate.

Fahrenheit.

Dec. 1894.	Ave. min. 25.15.	Ave. max. 45.9;
Jan. 1895.	Ave. min. 20.12.	Ave. max. 40.4;
Feb. 1895.	Ave. min. 13.65.	Ave. max. 33.95.

Throughout the entire mainland very light sandy soils predominate, although there are many beds of heavy clay, and ridges of road gravel, also sand and clay loams and vast stretches of mucky swamp-lands. The higher portions of the upland are usually gravelly, the intermediate sandy, and the lower, loamy and clayey. The farther south, the richer the soil and of course the thriftier the forest growth. The gravel is yellow and consists of small waterworn quartz pebbles mixed with sand and clay. When of the proper mixture and consistency it is an excellent and inexpensive road material. The abundance of such gravel in a country where the natural roads³ are bad is a

Physiognomy of the Mainland.

¹) One specimen of *Pinus Taeda* was discovered by Mr. Pinchot, and another by Mr. Arthur Hollick, in Southern New Jersey. The region of the Pokomoke River on the peninsula between the Delaware and Chesapeake is, as far as I have been able to observe, the most northern limit of the natural growth of the bald-cypress.

Northern limits of *P. Taeda* and the cypress.

²) According to the investigations of the U. S. Biological Survey, (See 'Laws of temperature control of the geographic distribution of terrestrial animals and plants' National Geographic Magazine Vol. VI Dec. 1894) the northward distribution of terrestrial animals and plants is governed by the sum of the positive temperatures for the entire season of growth and reproduction, and that the southward distribution is governed by the mean temperature of a brief period during the hottest part of the year. According to Prof. Merriam the species of the Carolinian belt require a total quantity of heat of at least 6400° C or 11500° F, but apparently can not endure a summer temperature the mean of which for the six hottest consecutive weeks exceeds 26° C or 78.8° F. The northern boundary of this zone therefore is marked by the isotherm showing a sum of normal positive temperatures of 6,400° C or 11,500° F. While its southern boundary agrees very closely with the isotherm of 26° C or 78.8° F for the six hottest weeks. The minimum temperature was assumed to be 6° C or 43° F, that is, the point where metabolic processes are just possible.

Temperature and life zones.

³) Very wide-tired wheels are gradually coming into general use. This will have a very beneficial effect on the roads of this region. A five-inch tire should be used on all South Jersey gravel roads.

Wide-tired Wheels.

fortunate coincidence. When sand and gravel are cemented together by compounds of iron, as is often the case, a durable conglomerate is formed, which is the principal building stone of the region.

The sources of the rivers of the Coastal Plain are on its northwestern edge and the land slopes gradually to the sea and is so level that tide-water penetrates far into the interior. The tide rises and falls six feet so that the roots of trees along the rivers are often moistened twice daily by the water which seeps into the soft sandy soil.

The Plains.

Area and Form.

The Plains¹, are extensive, practically treeless regions in the northern part of the Coastal Plain. The region called the East Plains contains 6662 acres², and the West Plains 7737 acres. There are other areas of the same nature, so that 20 000 acres is a conservative estimate of the amount of land of this kind. These Plains are hilly, the hills being about one hundred feet above sea level, and with very gentle slopes. The surface soil is usually a bleached sand. Often there is a subsoil of clayey loam and gravel at varying depths. Often the subsoil is quite hard and in places there are beds of conglomerate and strata of clay. There is practically no physical difference between the soil of the Plains and the soil of thousands of acres in the neighborhood on which trees of good dimensions are growing. Owing to the hilliness of the region in comparison with the surrounding country, and, owing to the lack of a more extensive cover, the soil has been subjected to the leaching and beating of rain, and the scorching and drying effects of the sun and wind. One would expect to find it therefore exceedingly poor in quality, with a dearth of plant food, which might, at least in

Nature of the Soil of the Plains.

The Terms "Plain" and "Plains".

¹) The term "plain" is usually applied to broad stretches of country which are level or undulating. Owing to the fact that vast treeless areas in the west are called "The Plains", treelessness is popularly associated with the word "Plain". For this reason no doubt certain treeless regions in New Jersey are called "The Plains", although they are hillier than the surrounding country. Geographers however apply the term to level regions regardless of their cover for instance, "the Atlantic Coastal Plain". It is worthy of note in this connection that the people of the west distinguish between the "Plains" and "Prairies". The term "Prairies" is applied to the region between the 104th meridian and the eastern base of the Rockies. Their treelessness is mainly due to a lack of moisture. East of this are the "Plains", a fertile but formerly treeless region. The absence of trees is here due rather to the extreme fineness of the soil or to fire and grass than to moisture conditions.

An acre in hectares.

²) One acre equals 43,560 square feet or about two-fifths of a hectare and one hectare equals 2.47 acres.

The term acre is the same as the German "acker" and originally meant the amount that one man could plough in a day. Land is still roughly measured by the natives by the "morgen" and "tag-werk". The old French word "arpent" is a measure of land which roughly corresponds to the acre and is still used in Louisiana.

part, account for the absence of a more extensive growth. A chemical examination disappoints one in this respect, since it shows that the soil of the Plains is not only as rich, but considerably richer than in regions near by, on which thrifty trees are growing. An analysis shows the following.

	Soil of Plains.		Soil of land adjacent where goodsized trees are growing.		Analysis of Soil.
	No. 1.	No. 2.	No. 3.	No. 4.	
Nitrogen	0.06	0.03	—	—	
Phosphoric acid	0.17	0.19	0.02	0.01	
Potash	0.05	0.02	—	—	
Lime	0.06	0.02	—	—	
Silica. insol.	96.40	96.95	97.60	97.28	
Alumina	1.15	0.28	—	—	
Ferric oxide	0.40	0.20	—	—	
Ferrous oxide	1.26	1.06	—	—	
Magnesia	0.04	0.02	—	—	

I carefully collected the specimens of soil, and the analysis was made by the chemical department of the New Jersey Agricultural Experiment Station for the Geological Survey of the State of New Jersey.

Not only does the above analysis show that the Plains are richer in plant food than the surrounding region where merchantable timber is growing, but also perhaps, that they are physically superior owing to the presence of a small quantity of alumina. This analysis shows also upon what extremely poor soil trees will grow, provided it is soft and a little moist. These specimens were selected from near the surface; deeper, no doubt, the soil is richer.

The Plains are covered with a low bushy growth of several species. The highest tree measured, in this whole region was fifteen feet (four and one half metres). It was a sassafras. The most peculiar feature of this area is the fact that a large part of the growth is a coppice of pine. By the natives these short stunted pines are called "she-pines"¹. They are the stool-shoots of *Pinus rigida* commonly called the rough-bark or pitch-pine. When this pine is cut, many shoots sprout from the

Nature of
growth
which covers
the Plains.

¹ The term "she-pine" or "she-pitch-pine" is also applied to *Pinus heterophylla* which grows in the region of the Gulf of Mexico. In the language of the natives the prefix "she" indicates not sex but inferiority and imperfection. *P. heterophylla* has been regarded by the lumbermen as a tree of very inferior quality and of little value in comparison to the true southern pitch pine (*P. palustris*). In the same way the term "she-balsam-fir" is applied to *Abies Fraseri*, a small, short-lived tree which inhabits only the high slopes of the Alleghany Mountains in Carolina and Tennessee. For the same reason the adjective "bastard" is often applied to trees.

"She-pines".

Tendency of
the Pitch
Pine to send
out Shoots.

Persistence
of Pine Coppice
on the
Plains.

stool¹, but since insects soon attack and devour it, the young shoots usually die in consequence, while still small and tender. There is a strong tendency in the pitch pine (*Pine rigida*) to send out shoots, especially when growing under adverse conditions. Soon after a fire, with the foliage completely burned, and the bole girdled near its base, many dormant buds in the crown develop into shoots which soon however wither and die. Even logs which have been cut and hauled to the mill, send out similar shoots while lying in the lumber pile. Ordinarily a pine coppice is short-lived, but on the Plains it has persisted for many years. Fire sweeps over this region frequently and burns the shoots while still only a few feet high, but the stump, gnarled, charred, and full of pitch continues to live. Some of the stools appear to be more than a hundred years old and are not more than five or six inches in diameter. Hard and prickly cones are produced in large numbers, with imperfectly formed seeds. *Quercus pumila*², the scrub or bear

Stumpage.

¹) The term "stool" is seldom used in America. The word "stump" and its derivative "stumpage" are in constant use. Stumpage means standing timber considered with reference to its value for cutting, so-called because the amount cut is ascertained by counting and measuring the stumps.

Second
growth.

Seedling
forest.

Rotation.

According to several botanical works a "stool" is "the parent plant" from which young individuals "are propagated by the process of layering". If this is so the terms "stool" for stump and "stool-shoot" for coppice-shoot which are commonly used in forestry publications are not strictly correct. It is worthy of note in this connection that the word stumpage as well as other words of a similar nature in English has two or three other meanings in certain localities. The word secondgrowth is also loosely used. In some places it is applied to any growth which follows the first cutting. The coppice growth in South Jersey which has been cut over many times is still called second-growth. Some claim that it should only be applied to a seedlingforest. For seedling forest the Germans use the word „hochwald“ or highwood whether two feet or two hundred in height. It is not always well to literally translate words in use in forestry in Europe. The word rotation, for instance, in agriculture is explained by the following illustration: If corn is planted on a field with crimson clover one year, then in the fall wheat with grass and then after the grass, corn is again planted the rotation is complete. It is the length of time from corn to corn and implies alternation. In a forestry sense it is applied to the length of time between planting and the final cutting and implies no alternation. Someone in India has suggested therefore that the word „revolution“ be used in its stead.

The Scrub-
oak.

²) The scrub-oak (*Quercus pumila* formerly *Q. ilicifolia*) is very common but never reaches the dimensions of a tree. It endures extremely adverse conditions and bears immense quantities of small acorns. It is an excellent protection to the soil which would be otherwise bare although it furnishes food for fires. Its mast is relished by swine and other animals. It is sometimes cut for umbrella handles and canes. Many of these scruboak regions are excellent places for fashaneries or pheasantries. Both the partridge (*Colinus virginianus*) and the pheasant (*Bonasa umbellus*) are fond of its acorns. The Heath or Prairie Hen (*Tympanuchus cupido*) which is now extinct except on Marthas Vineyard Island, inhabited, it is said, the Plains of New Jersey up to 1868.

oak, and the Jersey laurel¹ (*Kalmia latifolia*) are abundant. There are also many interesting herbaceous plants or low shrubby plants such as the pyxie, the bearberry and the trailing arbutus.

The only tradition attached to these wind-swept, sun-scorched Plains is that they have always been treeless. They are often dreary and black from the effects of fire but soon Nature covers them with a blanket of green, and they glow in season with the bloom of wild flowers. It is always however a lonely place and is seldom visited save by natives who come to gather the stools of the pines which are full of pitch and excellent for fuel.

The Plains condition is mainly due to fires which are very common throughout the region, and which have doubtless burned for many years, probably since the days of the Indian who often passed that way en route to the sea shore. In the Coastal Plain, all gradations from a healthy pine forest to the scrubby plains may be seen. In fact, through the effects of fire other regions are rapidly becoming Plains-like in character. This particular region has first become Plains, because it is hilly and higher in altitude. It suffers more from drought, and in consequence has been more easily changed by fire. It is not unlikely on the other hand that the Plains have never been forested and that for ages Nature has been striving to cover them with trees, but fails owing to fires and the dryness of the soil.

The Cause
of formation
of the Plains.

Surrounding the Plains on all sides and extending far to the southward is an immense tract of land called the Pine Barrens. The term is usually applied to the sandy regions of New Jersey which are covered with a sparse growth of pine under which as a rule there is a scrubby growth of oaks and ericaceous plants. The physiognomy of this region is mainly due to fires and careless cutting. In a few places which have been protected there are magnificent forests of smooth-bark-pine and even merchantable oak, in spite of the sandy nature of the soil. In a few of these forests affected only by surface fires which burn quickly over the thin covered soil, the ground is white and clean. In other instances where there have been no

Pine
Barrens.

Although not introduced for forestry purposes the scrub-oak is quite common in parts of France. See latest edition of Mathieu's „Flore Forestière“.

¹) The laurel is a beautiful evergreen slow-growing shrub which thrives on barren land in spite of fire. The rich white and pink corymbs of this plant mixed with its coriaceous leaves are abundant and attractive. In rich damp woods it often reaches the dimensions of a small tree and its wood, as with the crooked limbs of the red-cedar, is extensively used in the construction of „rustic-work“, a term applied to fences, pavilions and garden furniture made of the crooked limbs and roots of several species of trees and shrubs.

The Jersey
Laurel.

fires at all, although these spots are few and far between, there is a stand of tall, clean, smooth-bark-pine (*P. echinata*), with a dense underwood of chestnut oak (*Quercus Prinus*). The heightgrowth of the pines has been stimulated by a thick covering of mellow humus. They are samples of what is possible on sandy soil.

In the spring when there is a richness of bloom and beauty, and during the Indian summer, when the woods are gorgeous with autumnal tints, and enlivened by the chatter of birds feeding upon the harvest of berries, fruits, and seeds, the atmosphere of the Pine Barrens is balmy and fragrant. The winter also is pleasant, owing to the freshness of the evergreens and the dryness of the soil, but in summer the sand is hot and dry, and the air is full of pestiferous flies and mosquitos, and hazy with smoke from forest fires.

Atmosphere
of the
Barrens.

The natural
regeneration
of old fields.

In early times, settlers cleared the land along certain thoroughfares, irrespective of its quality. Soon many of their farms became barren and with a change of industries they changed their homes and abandoned their fields. When a sandy field in the Jersey pine land is abandoned to Nature, she clothes it at first with a sparse covering of lichens, Indian grass, briars, *Hudsonia tomentosa*, and other pioneer herbaceous and shrubby plants. Soon, scattered red cedar (*Juniperus Virginiana*) and holly (*Ilex opaca*) appear as fore runners, the seeds of which have been dropped by passing birds. The persimmon and sassafras, hardy oaks, and wild cherry (*Prunus serotina*) also spring up, and near the sites of old dwellings are clumps of the tree of heaven, (*Ailanthus glandulosus*), root suckers from the old trees which were once in favor for shade and ornament; here and there pines appear; the edges gradually close in on the field; the solitary forerunners become surrounded by their progeny; the gaps are slowly filled by whatever may chance to fall, by the many natural means of seed distribution. Thus in time the whole becomes a mixed forest of many species and of all age classes; here a thicket, there a polewood, consisting of softwood and hardwood, evergreen and deciduous sorts, many sickly suppressed trees, and many much branched, rough and knotty trees, which were the forerunners, holding their own in the struggle for life even against their own progeny. Soon come axe and fire; the weaker kinds perish, the best are used, and pitch pine and a coppice of hardy oak alone remain. Sometimes, if surrounded by pine, these old fields come up in a growth of pine as thick and green as a field of grain.

The forests of the Eastern United States are possessed of marvelous regenerative power. Among the hundreds of native species there are many capable of great endurance, and, indeed, in the regions east of the western prairies there are few spots

so sterile and inhospitable that one or more of these species cannot survive.

A very large part of the Pine-Barren district is oak coppice. It is what the Germans would call a „niederwaldartige mittelwald“. The area in pine is constantly decreasing, the area in oak increasing. Oak of some kind almost invariably follows pine. Throughout every pine woods, are scattered here and there suppressed oaks, the seeds of which may have been dropped by jays or chickarees. Just as soon as the pines are cut, these oaks, owing to increase of light and room grow quickly. In spite of the poverty of the soil and the inroads of insects, and although burnt, and cut again and again they show remarkable vigor.

Oakcoppice.

Many dry leaves cling to the small oak trees until the following spring; the limbs reach close to the ground, and fire therefore in the late winter or early spring, before there is much sap in the wood, kills them, although the stumps live on, and with great persistency produce a fresh growth. In the struggle for existence the scrub oak and the black jack (*Q. Marilandica*) usually survive. Although these two oaks are of slight economic importance, it is due to their pertinacity, that in many places the soil has been prevented from shifting. The species which form this coppice are, post oak (*Q. minor*), black oak (*Q. velutina*), white oak (*Q. alba*), chestnut oak (*Q. Prinus*), Spanish oak (*Q. digitata*), red oak (*Q. rubra*), black jack (*Q. Marilandica*), and scarlet oak (*Q. coccinea*). Hybrids and irregular forms are common. The coppice is usually cut as polewood for fuel, and has little value. Owing to careless cutting the stumps, are apt to be partly decayed. This decay spreads to the tree. It also invites the inroads of insects, the number of which injurious to these oaks is legion.

The wonderful rapidity of tree growth in this sandy soil is often remarked with surprise. Bleached white as snow, and apparently, absolutely destitute of plant food it is nevertheless capable of supporting a thrifty arboreal growth. The young tree starts with the greatest difficulty and languishes throughout the early part of its life, but as soon as its roots have reached the deeper and richer layers of the soil it starts afresh and grows thenceforth with astonishing rapidity. The soil is porous, and although well drained, is moist a short distance below the surface. The lay of the land, and the nature of the soil is such that the roots of trees can easily penetrate to where there is constantly sufficient moisture. From the Plains, the highest part of the Coastal Plain, there are naturally all degrees of soil moisture conditions, through the Pine Barrens to the swamp lands.

Rapidity of
treegrowth
on sandy soil.

A swamp is usually defined as a tract of land with or without trees, lower than the surrounding country, and so saturated with water as to be unfit for cultivation.

Swamp
Lands.

Definition of
Swamp.

This definition however is insufficient. When one speaks of a swamp in Southern New Jersey, or in any part of the Southeastern States, a wooded region is usually meant. A swamp also is not always unfit for cultivation. Some of the best farm land in America is on swamp bottom. Neither is it always lower than the surrounding country. Elevated swamps are common, and the Dismal Swamp of Virginia and North Carolina, which is like a Jersey swamp in many respects, is several feet higher than the surrounding country, with a lake in the centre from which water runs in all directions. This swamp however was formed in a depression, nay more, the place it occupies was once an arm of the sea. Were shifting sands to clog up the inlets of New Jersey, the bays and marshes would become fresh, and in time no doubt would form swamps similar to the Great Dismal of Virginia. A swamp may be formed even in salt water in southern latitudes by masses of the mangrove tree. The amount of water in a swamp is an important matter, also the temperature of the water. It varies in amount from a degree of mere moistness to the condition of the Cypress swamps of the south, which are at times navigable for canoes, bateaux and often good-sized scows. Along the Mississippi River there is a vast region called the River-swamp, which in seldom completely flooded. Here, several of the trees which grow in southern New Jersey reach their optimum. Many trees which thrive in water in the south, cannot live in the swamp lands in the north, because of their coldness, but thrive on the upland. By the term swamp is merely meant a wet muddy region, covered with a wild growth of trees and bushes.

The River
Swamp.

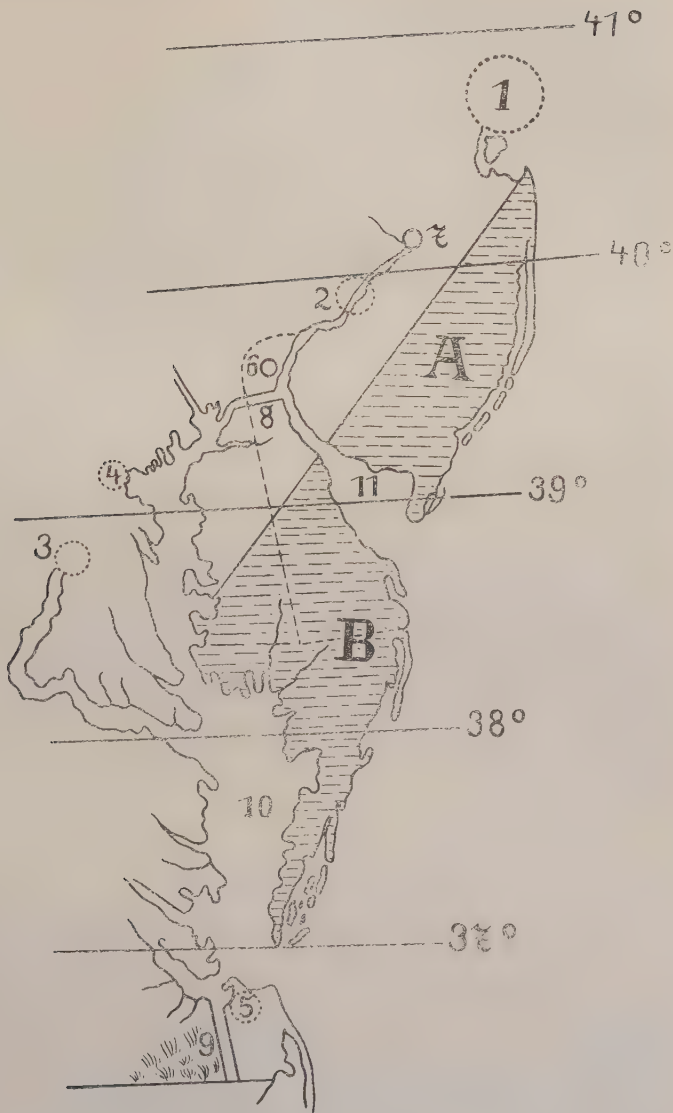
Bog, marsh
and savanna.

To wet, almost treeless, or treeless areas the terms savanna, morass, bog, slough, and marsh are applicable. The term savanna is usually applied to lowlands covered with grasses and other herbaceous plants; the terms morass and bog to extremely spongy, sphagnaceous lands, and the term marsh to the soft muddy deposits around and along bodies of both salt and fresh water. Some are inclined to restrict the term marsh to those areas formed in salt water. There is little reason for this, since salt and fresh marshes are essentially alike in formation. All these terms are unfortunately exceedingly elastic in meaning. A cedar swamp for instance is a swamp while covered with trees, but when cut over, cleared, and planted with cranberries, it becomes a bog.

Swamp
bottom.

Much of the swampland in the Coastal Plain of New Jersey, although merely moist and extremely fertile, will probably remain in woods for many years to come, because of the difficulty in clearing it. A swamp bottom consists of the forest detritus of ages, and is a matted mass of roots, stumps and tree trunks.

The Swamp land may be divided into Cedar-swamps, and deciduous or hardwood-swamps.



- A = Coastal Plain of New Jersey.
 B = Peninsula between (10) Chesapeake and (11) Delaware Bays.
 1. New York and Environs. 2. Philadelphia. 3. Washington,
 4. Baltimore. 5. Norfolk. 6. Wilmington. 7. Trenton. 8. Delaware and
 Chesapeake Canal. 9. Dismal Swamp Canal.

Cedar
swamps.

The white cedar (*Chamaecyparis thyoides*), the finest soft wood of the region, grows in dense pure forests. The tree is tall, straight, and sharp pointed. The bases of the crowns meet to form a solid canopy. The trees grow so close that one supports another, and when a few are cut, or felled by storm, others in the neighborhood, deprived of their support, fall in every direction. The limbs are often festooned with a gray lichen (*Usnea barbata*), the pendant tufts of which are favorite nesting places of the Parula warbler (*Compsothlypsis Americana*). These swamps are warm and protected in winter and harbor therefore many birds. They are cool in summer and fragrant with the odor of clethra (*C. alnifolia*) and magnolia (*M. glauca*). A cedar swamp bottom seldom freezes.

Nature of the
Forest floor.

The forest floor is usually covered with a thick mat of spongy sphagnum moss. The streams in passing through the swamps often separate into several streamlets, which meander through the mass of moss and submerged tree trunks and roots. The water of these in dark places is black as ink, but in the light, and in shallows is the color of mahogany or amber owing to impregnations from the humus. Nothing is more characteristic of the Coastal Plain of New Jersey than these swamps of Cedar. Although practically the northern limit of this excellent species, it is perfectly at home in South Jersey. Free from disease, and always a fresh rich green, cedar swamps form the most striking feature of the landscape. This species should not be confounded with the white cedar or arbor vitae of the north (*Thuja occidentalis*). It is a common saying in South Jersey that a cedar swamp attracts a shower. It seems to be often the case that a thunder storm follows a branch or stream until it reaches a mass of swamp and there drops its rain.

Cedar
swamps and
Showers.

Owing to the excellence of the wood these swamps are devoured with avidity by lumbermen. The bottom when not too difficult to clear and when properly located, is in demand for cranberry bogs.¹ When a cedar swamp is cut or burnt, if

The Ameri-
can cran-
berry.

¹) The cultivation of the large or American cranberry (*Oxycoccus macrocarpon*) is a very important industry in South Jersey. The berry, the size of a cherry, grows in large quantities on a low creeping vine which forms a mat on the surface. The clearing and preparation of these bogs are expensive but the yields are often enormous and the bog lasts for many years without perceptible deterioration. The cultivation of this plant requires skill and experience. In times past fortunes have been lost as well as won in the cranberry industry. The amount of fruit yielded year after year by a bog suitably located and tended is often enormous. A cedar-swamp bottom through which there is a running stream is selected. This is banked and arranged so that the bog can be easily and quickly flooded since it is desirable to keep it covered with water throughout the winter and for a short time at other seasons of the year, to protect it from frost, to drown out undesirable weeds and

certain conditions prevail, it may come again in cedar, usually however deciduous swamp trees, inferior in nature, usurp its place.

The swamp lands being moist, have naturally not suffered from fire as much as the uplands. They often consist there fore not only of a great mixture of species, but are a semi-tropical tangle of wild grapes, and other vines and bushes. The deciduous or hardwood swamps usually contain a mixture of the following trees of more or less importance. *Acer rubrum*, red or swamp Maple, *Liquidamber styraciflua*, sweet gum or bilsted, *Nyssa sylvatica*, black or sour gum, and *Magnolia glauca* or brewster, are the commonest. In some swamps there are beeches (*Fagus latifolia*), tulip trees (*Liriodendron tulipifera*), swamp white oak (*Quercus platanoides*), willow oak (*Q. phellos*), holly (*Ilex opaca*), sassafras (*S. sassafras*), and now and then a pitch pine (*Pinus rigida*), a smooth bark pine (*Pinus echinata*), a white cedar (*Chamaecyparis thyoides*) or even a white pine (*Pinus strobus*).¹

Hard wood
Swamps.

Fire and the axe have converted many of these swamps into sorry looking thickets and cripples,² which are little more

Thickets and
Cripples.

insect pests or prevent a fungus disease called „scald“. A bog may be flooded at any time without injury to the vines except when in blossom. In clearing a bog the stumps are usually removed but not always. The whole is turfed with a cranberry-or bog-hoe, which has a wider blade than the ordinary grubhoe. Ditches are dug throughout the whole bog and sometimes the surface is sanded. It is planted in a simple manner with a suitable variety of wild-berry from the woods or from another bog. Usually the vines are mown down with a scythe. These pieces are dropped over the area ready for planting and pushed into the soft soil with a wooden dibble. They soon take root and in the course of a couple of years their vigorous stolons have complete possession of the soil.

¹ It is in these swamps where the animals of the woods take refuge, especially the deer which at a certain time of the year when the law allows are remorselessly chased by packs of hounds. The extinction of this animal in New Jersey is only a matter of time unless the use of dogs is absolutely prohibited at all seasons. It is the common Virginian or white-tailed deer of the Eastern United States (*Coriapus Virginianus*). Hunting in America is every body's privilege and in every back-wood's town there are local social gypsies or pothunters who love sport and hate work, who spend their days wandering in the woods with dog and gun and their evenings in the country store or tavern relating their experiences. Several animals in South Jersey are hunted not for their pelts or for food but for the bounty which the townships very foolishly pay for the heads of certain so-called „depredatory animals“ among the worst of which the fox is classed. From a forestry standpoint the fox (the red fox which has superceded the grey fox) is the most useful of forest animals. It in no way injures vegetation or seeds and preys upon such animals as mice which are capable of causing a great deal of damage to young trees and seed-beds.

The Virginia
deer.

The fox.

² The term „cripple“ is a localism used in South Jersey and on the Chesapeake peninsula. It is applied to a thicket or useless bushland.

Cripple.

than tangles of saplings, bushes and vines. It is easy to imagine how, in the course of time, fire, burning over land of heavy nature or land which is usually moist, will gradually kill even swamp trees and shrubs, until nothing remains but herbaceous plants among charred stumps. These swamps often become very dry in summer and the natives, to improve the quality of the berries (or very rarely the pasturage), set fires. In this way moist swamps become meadows. This land, if left to itself and protected from fires, soon recovers, but there is another kind of grassy land, namely "Savanna", which is of little worth and destined to remain unchanged for many years to come.

Savanna
land.

The formation of such grass land in New Jersey is usually due to a hard-pan which is often only a few inches below the surface. Hard-pan is the name applied to a dense, almost impenetrable stratum of compacted material. It is generally soil in the process of becoming rock. In these savanna lands¹ it is bog-ore and organic materials cementing the particles of sand. It is covered by several inches of humus, which is saturated with water. This water is more or less stagnant, and the land is extremely sour in nature. Here and there on knolls in these sloughs, a pitch pine grows, but topples over in the course of time, owing to the slight hold which it has upon the soil. The hard-pan is similar to the alios of the French Landes. This stratum exists in all degrees of hardness, and often in sufficient quantities to prevent the growth of trees on considerable areas of land, but in a region where even good land has little value, the comparatively small area of savanna is not worthy of much consideration, because the cost of drainage and preparation would amount to more than the land is likely to be worth.

Hard-pan.

Salt Marshes.

Stretching along the coast of Southern New Jersey and along the Delaware River, fringing the mainland and bays, and extending along the rivers far inland, are many miles of salt marshes. They are of course treeless. When banked and sluiced they shrink and become fresh. In former times these lands were banked and cultivated much more extensively than at present. Owing to the difficulty of keeping the banks in order, they have in large part been abandoned. The marshes, endless

Savanna.

It is interesting to note that the Germans use the word in the same sense. For instance a stand of trees which has been abused by careless cutting etc. is called a „Krüppelbestand“. Under brush is sometimes called „Krüppelholz“.

¹) I do not mean to indicate that all land in America which is called savanna is caused by a hardpan. The term is a relic of the Spanish in America and in general merely means a tract of level land covered with low vegetation usually grass. It is used also in India in this sense. In old Spanish the word means a „sheet“ and was originally applied to a flat snow-covered region.

to the eye, are intersected by many bays, salt ponds, thoroughfares and winding creeks. They yield thousands of tons of salt hay (*Spartina juncii*), and black grass (*Juncus Gerardi*), extensively used for fodder and packing. It is transported on flat boats or scows up the many rivers to the interior, and is also baled and shipped to the neighboring sea-shore resorts, and cities. Owing to the fact that these marshes already yield a good income, that is a fair rate of interest on the amount invested, and probably more than cultivated fields would pay, by producing year after year, a good grade of hay without any labor except the reaping, and a little ditching now and then, it would be a precarious investment to bank and drain them as has been done with similar land in Holland, except perhaps in certain localities such as the immediate vicinity of New York city. These banked lands, although fertile, are unsatisfactory to till; the dykes are¹ a constant care and anxiety, and storms and high tides, besides other serious dangers often cause damage which obliges the farmer to mortgage his farm to repair.

Salt hay.

Banked
lands.

The reasons for mentioning these marshes in this connection are firstly, they yield an abundance of fodder and litter, and secondly the mud is an extremely rich fertilizer, consisting mainly of humus, but containing also lime, and the decomposed bodies of both macroscopic and microscopic organisms. It is an inexhaustible store of fertility. In it are the materials which the sandy soil of the interior needs most. By applying this mud in the fall, so that the frost will pulverize and mellow it, and, the following summer, sowing a leguminous crop for green manure, the sandiest field is rendered quickly fertile. This litter and mud are abundant and available to all those who have enterprise and energy enough to utilize them.

Salt mud for
manure.

The mainland and marine marshes are protected from the action of the ocean waves by a line of barrier beaches or sea islands. These beaches, on which are located many famous resorts, are separated from one another by inlets through which

Sea Islands.

¹) The banks are often seriously damaged by the musk-rat (*Fiber Zibethicus*) are aquatic rat-like rodent. It yields a salable fur and is extensively trapped. They dig through a bank in all directions causing it to leak and weakening it throughout in a way which is difficult to repair. They are prolific and must be combatted in various ways. Many encourage the presence of black snakes (*Bascanion constrictor*) which feed upon its young. A tight slab-fence is often constructed against the face of the bank, or small pilings are driven close together along its outer edge. Ditches should never be dug on both sides of a dyke, if so the rats are very fond of channeling from ditch to ditch. If sand is used in the construction of the outer part of a bank rats are less apt to disturb it because it caves easily and thus interferes with their digging. Willows should be planted on these banks and fascine and wattlework constructed on their faces.

The muskrat
and banked
lands.

Formation of
dunes.

the tide sweeps swiftly. Strictly speaking a beach is that part of a shore between high and low water, but in New Jersey the term is applied to what are really sea-islands. These islands consist of a fine white sand which in places is mobile. When the tide falls, the sand of the beach proper, dried by the sun and wind, is blown either inland or into the ocean. The prevailing winds blow toward the sea, and the sand as it dries, flies back into the water to be whirled again on the beach by the waves. If the wind continues for some time from the sea, sandhills are formed. Any small obstacle sufficient to diminish the energy of the wind, may cause the commencement of a dune. As soon as a little hill is formed, it is easy to see how it may continue to form while the conditions remain the same. Soon a strong west wind however may hurl it back into the sea, or an eastern gale fling it inland on the marshes. And so it goes, forming and reforming, changing in fact with every caprice of the wind, gentle and almost unnoticeable during a light sea breeze, but a stinging, blinding sand blast in times of gale. In case of an obstruction which interferes with the action of the west wind, a dune forms equal in height to the obstacle. A great deal of the land on these islands is now occupied by resorts; it is all in fact, owned by private parties, and is in places extremely valuable. But, here and there are tracts of wild, shifting dunes. At Avalon, there is a huge dune, caused by a dense forest which is being slowly but surely engulfed. The dune begins just above highwater mark, and then extends inland, gradually increasing in height until its summit is even with the foliage of the trees. It is a peculiar scene from the top of this dune; on the land side there is a dense mass of dark green foliage, beyond which there is the broad expanse of green salt marshes with their bays and thoroughfares. On the ocean side, sloping to the breakers, there is a huge mass of fine sea sand, out of which project the jagged trunks and limbs of smothered trees. The fine sand sifts into shoes, pockets, clothing and hair. It comes, fresh from the great ocean-mill, ascends the surface of the dune, and falls over its crest into the forest. When a stiff breeze is blowing, it skims along like drifting snow, and shoots from the summit of the dune, trimming the tops of the trees as flat as though shorn with shears.

The effect of
thickets.

If these forests are what cause the dunes, by preventing the west wind from blowing back the sand, how did the forests grow? Single trees here and there, or groups of trees, which are clean underneath, so that the west wind sweeps through without serious interruption, do not cause the formation of dunes. In the course of time however, a thicket forms under these trees. They become covered with grape vine and virginia creepers and green briars. The birds and winds scatter the seeds of many sorts of shrubs and bushes, such as *Prunus maritima*,

Myrica gale, *Baccharis halmifolia*, etc. etc. until a dense forest is formed through which the west wind cannot penetrate, the consequence of which, in the course of time is a dune, which in turn finally engulfs and kills the forest that had caused it.

It is a mistake to suppose that this sand is sterile because it appears barren. True, it consists mainly of granules of silica, but these are extremely fine, the interstices are small and the capillarity great in consequence; mixed with it are particles of shells and other materials, organic and inorganic, which are in the ocean, working down the coast until washed ashore and shifted with the sand.

Nature of the sand.

The forest at Avalon is so dense that many birds seek shelter there. The principal trees of these beaches are the Holly (*Ilex opaca*), the red cedar (*Juniperus Virginiana*), the sour or black gum (*Nyssa sylvatica*), magnolia (*M. glauca*), wild cherry (*Prunus serotina*), hackberry (*Celtis occidentalis*), sassafras, swamp maple (*Acer rubrum*), and a few oaks, and pitch pines and even red mulberry. The commonest, and by far the most characteristic trees of the beaches are the holly and red cedar. The holly thrives here, reaching a much larger size than on the mainland, apparently enjoying the moist, salt atmosphere and loose sand. It is a dunetree par excellence. Its limbs are close and jagged in striking contrast to the pyramidal, symmetrical holly trees of the inland open field. Its prickly foliage is a dense and dark green, and its crown is flat. It produces rich red berries in profusion, and its bole is bright grey in color, rugged and sturdy. It often disports itself like a member of the fig family. It is not uncommon to find two hollies grown together, or the limb of one tree growing into another tree, or a limb bending down and uniting with the trunk forming what the natives call jug-handles. Those who are familiar with the region, will never forget these groups of hollies, nor the masses of aromatic red cedars with limbs festooned with grey lichens.

Beach trees.

Beach holly and cedar.

There is but little danger lurking in these sandhills. They are, in this respect unlike the dunes of Gascony, which, if robbed of their forests would bury villages. The Jersey dunes are so wild and picturesque that many prefer to let them have their way; but the scenes on these beaches, so attractive and peculiar today, are destined to lose much of their charm by being transformed into resorts for recreation and pleasure.

Chapter II. Forest Utilization.

The Indian
and the
Forest.

The utilization of the Forests of America began with the Indian. The Coastal Plain of New Jersey however was very sparsely inhabited before Europeans landed. Here and there along the rivers may be seen the vestiges of Indian villages, pot-sherds, broken shells, bones, and bits of jasper. At certain times of the year large numbers crossed the state to enjoy for a time the bathing, and fruits of the sea, but the permanent population was never large. The Indian of New Jersey domesticated no animals and cultivated only a few plants. His clumsy stone implements were so unweildy and impotent that he was unable to exterminate animals or cut down forests. He depended mainly upon the fruits and animals of the woods. He needed only wood for fuel which was everywhere plentiful, and white cedar logs, out of which to shape his canoes. The rivers were his highways, the canoe his conveyance. Fires, no doubt were set both accidentally and purposely, but in Southern New Jersey, they were probably infrequent, and did comparatively little damage. Indians in parts of Western America still fire the bush¹ to facilitate hunting. They desire open prairies and intervals for their game. In many places east of the Mississippi River, after the Indians departed, prairie fires which they had purposely set every year, became less frequent, and forest vegetation in consequence began to appear on the open land. Thousands of bison were also a hindrance to forest growth. In New Jersey however there were no bison, and the Indian himself was little more than an animal of the woods.

Indian and
fires.

Indian tree
names.

He has left his impress upon the country however, and Indian words are indelibly attached to many localities, and to the names of many plants and animals, such as skunk²), per-

The "bush",

¹) The term "bush" is a peculiar one. It usually means a single low woody plant. In certain regions however it is applied to a wild forest with a dense underbrush. The sugarmaple forest or orchard is sometimes called the "sugar-bush". The word in Dutch is "bosch" and means forest and no doubt the Hollanders were the first to apply it in this sense in South Africa and America. The word "bois" in French and "bosco" in Italian are probably modifications of the same word.

The skunk.

²) The skunk (*Mephitis mephitica*) is one of the commonest and most disagreeable of all the animals of Eastern America. It produces a salable fur called "Alaska sable" and in spite of the facts that it emits a nauseating odor and that a kind of hydrophobia results from its bite, it has been kept in confinement and bred for its pelt.

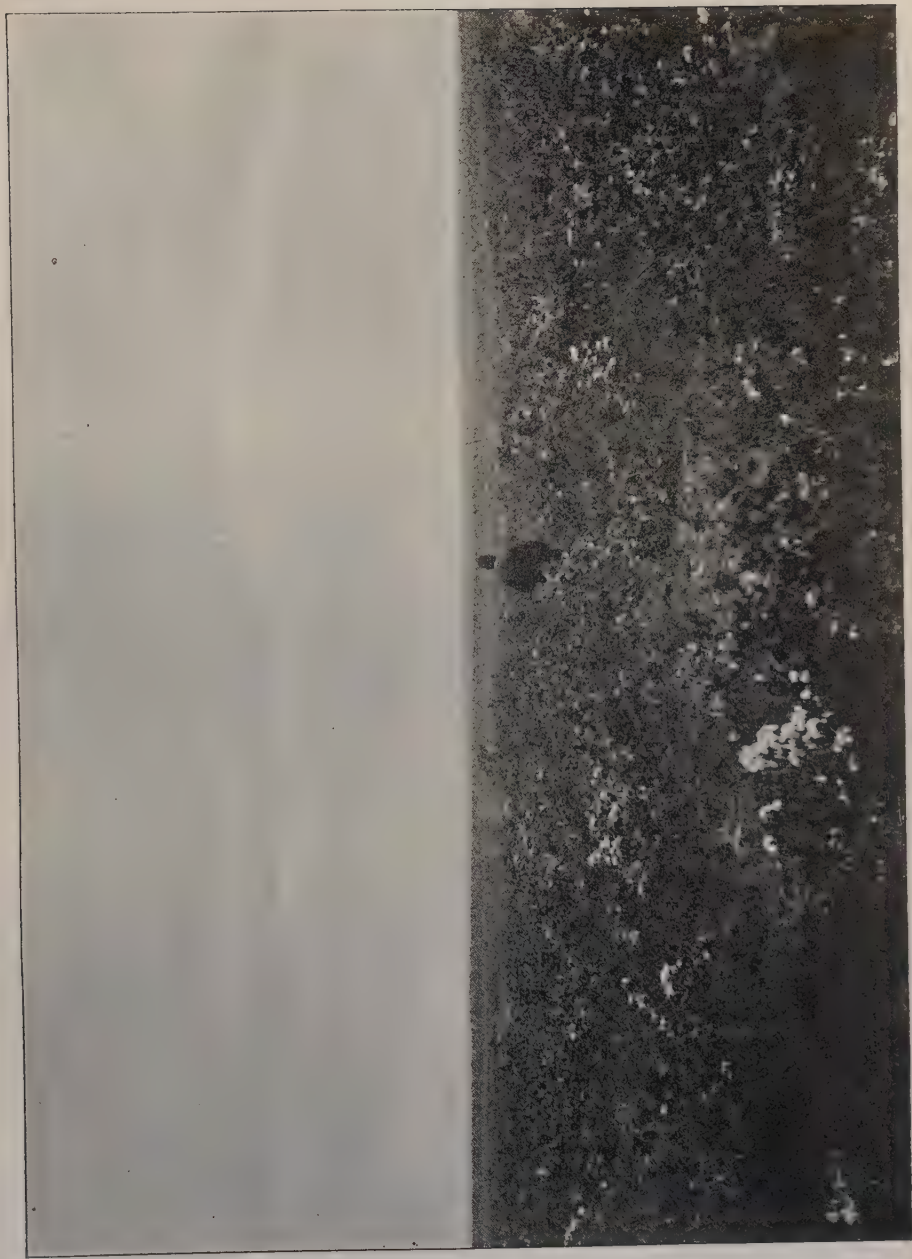


Plate II. The Plains of South Jersey. The light spots are the flowers of *Kalmia latifolia*.

simmon, chinkapin (*Castanea pumila*), hickory¹⁾, tamarack (*Larix americana*), mahogany, pecan etc.

Although the Algonkin Indian of New Jersey was dependent upon the forest and still in a primitive state, he cultivated small patches of maize and perhaps other vegetables, and was familiar with the edible wild plants. From the Indian, the whites learned of a tree (*Acer saccharum*), with a sweet palatable sap that grew in the northern mountains. The settler, in times of famine often, appealed to the Indian, and many of the fruits and vegetables upon which he fed have been since neglected. The Indian club²⁾, and the Indian fig³⁾, for instance, two of his important foodplants, are worthy of cultivation and improvement.

Indian food
plants.

It may often be the humblest and least conspicuous plants which yield the richest food materials, and not always the major forest products which, considering labor and time, yield the largest returns. The salep⁴⁾ of Turkey and the truffles⁵⁾ of France are excellent examples. It is worthy of note in this connection that the Indian was an expert basket maker. In fact the weaving of baskets preceded the production of pottery. On the bits of pottery, which are abundant in the neighborhood of old Indian camp-sites, may be seen the imprints of the basket in which the pot or bowl was moulded. For this purpose he used the rootlets, bast, and twigs of several species of trees. I have been told that in the west he would even set fires in order to secure fresh shoots for basket-work.

Indian
basketry.

The Indian of New Jersey was soon superseded by the settler, who, provided with two powerful implements, the axe

¹⁾ The word "hickory" is no doubt of Indian origin since the genus and word are peculiar to America. The terms "walnut", "white-walnut", "sweet-walnut" and "shag-bark-walnut" are often very inaptly applied to *Hicoria ovata*, the shag bark hickory. The word "walnut" itself means "foreign-nut" and should be confined to the genus *Juglans*. I have heard the Indians of Mexico and Central America call their gourd like drinking cups "hickories", whether the same word or not I am unable to say.

The word
"Hickory".

²⁾ The Indian-Club or Never-wet (*Orontium aquaticum*) which grows in immense quantities on the river flats of south Jersey was one of the Indians most important food plants. According to the accounts of early writers it is necessary to boil the large fleshy rootstocks half-a-day to render them palatable. I have been told that the seeds of the Japanese species (*O. Japonicum*) are boiled and eaten like peas by the natives and that the leaves when tender furnish food for cattle and swine. Cattle are fond of the young leaves of the American species and ducks and geese feed upon its green utricles.

The Indian-
Club or
Never-wet.

³⁾ The Indian-fig is *Opuntia vulgaris* and although its cladodes and fruits are covered with fine spines, it can be easily propagated and improved. It has large bright yellow flowers which have sensitive stamens.

The Indian-
fig.

⁴⁾ Salep is a farinaceous food obtained from the tubers of wild orchids. It contains a substance called bassorine which is very nutritious.

Salep,

⁵⁾ Over 3 000 000 dollars worth of Truffles are exported annually from France. They come mostly from Perigord and grow in limestone regions on the roots of oaks.

Truffles.

Peltry.

and the gun cleared small patches of land, and built cabins along the rivers. Trapping was the settlers¹⁾ first occupation, and peltry was one of the first and most important products of the virgin forest. Hunting and trapping in early times were hazardous, but often lucrative occupations. The forest was difficult to clear, and just as the young poplars today harass the New England farmer, by invading his pastures, and the mink²⁾ and fox rob the hennerly, so in early times a hundred fold more bothersome were the suckers and seedlings, and animals, from the woods between the clearings. Fire was freely used, and from the ashes, potash was extracted by leaching. This lixivium, by mixing with grease produced soft-soap which is still manufactured by country people. In many places today, wood is extensively burnt for its ashes and used as a fertilizer.

Wood ashes.

Ship
Building,

Soon shipbuilding developed into an important industry. Oak and pine of the finest kinds were plentiful. Saw mills were built along the streams, and lumber was shipped even to the West Indies in exchange for rum, sugar, and molasses. The construction of schooners continued until recent times, to be an important industry. Now, only small sloops, scows, and bateaux are built. Ships of iron propelled by steam have superseded the clipper.

Charcoal.

Scattered here and there throughout the Pines are the remains of what were once centres of a flourishing industry. This was the manufacture of iron from bog ore (limonite). In some places the furnaces and forges have been completely obliterated and forgotten; in others only bits of black slag remain, while in others the ruins are still standing. These

An old seal.

¹⁾ The spirit of these early settlers is well expressed in the motto on "The seal of the Territory of the U. S. N. W. of the Ohio River", impressions of which are preserved in the department of State at Washington. "A study of this historic seal will show that it is far from being destitute of appropriate and expressive meaning. The coiled snake in the foreground and the boats in the middle distance; the rising sun; the forest tree felled by the ax and cut into logs, succeeded by, apparently an apple tree laden with fruit; the Latin inscription 'melio rem lapsa locavit', all combine to forcibly express the idea that a wild and savage condition is to be superseded by a higher and better civilization. The wilderness and its dangerous denizens of reptiles, Indians, and wild beasts, are to disappear before the axe and rifle of the ever advancing western pioneer, with his fruits, his harvests, his boats, his commerce, and his restless and aggressive civilization". "Melio rem lapsa locavit!" "He has planted a better than the fallen!" See "Conquest of the Country Northwest of the River Ohio" by Wm. Hayden English. From the beginning the American has been the apostle of expansion.

Minkeries.

²⁾ There is no reason why many of these wild animals should not be bred for their pelts. The mink, for instance, has been tamed and reared in minkeries in New York State. It has been said that a mink is as profitable as a cow. Coues in his "Fur-bearing animals of North America" says "Were not fashion so notoriously capricious, mink pelts would maintain a conspicuous place in the furmarts of the world; certainly few surpass them in richness of color, gloss and fineness".

centres of industry, usually located in the neighborhood of streams and bogs, were connected by stage routes along which here and there were clearings and taverns. Immense quantities of charcoal were consumed by these forges and furnaces, the owners of which usually possessed the land for several miles in every direction. Wood in those days was in demand, and coalings were frequent. Even after the iron industry in the Pines succumbed, charcoal was shipped to the cities by schooners in large quantities. Owing to the abundance of other forms of coal, the demand for charcoal has gradually decreased. Along the rivers there were many dépôts to which the charcoal was carted, which are still in evidence owing to the great masses of coal-dust which accumulated there. Coal and iron were worked side by side in the neighboring state of Pennsylvania, transportation by rail increased the competition; the iron industry in the Pines was unable to survive, and with it faded the manufacture of charcoal, and the value of coalwood. The ruins of furnaces, the large dilapidated houses, the overgrown roads, the wharves, the piers, the old ship yards, and the masses of coal dirt on the landings are evidences of what the country was when iron was made from bog-ore, and when schooners were built to trade to foreign lands. The woods were full of men hewing timbers, cutting coal-wood, working in the coalings, raising bog-ore and carting materials from place to place. The death of these industries however is only the result of progress. In the development of the whole of a country, certain parts, although they may once have played an important rôle, must suffer. A series of industrial waves passed over south Jersey, some of which were of short duration, while others continue. Brick and glass factories are still active, and consume immense quantities of wood for fuel.

Cause of
decline of
Charcoal
industry.

Another peculiar old-time industry was the mining of cedar. The bed of a cedar swamp is a mass of forest detritus, several feet in depth, in which there are logs of white cedar perfectly preserved and excellent in quality. The white cedar, like the cypress of the South reaches a ripe old age. Over one thousand annual rings have been counted in buried stumps six feet in diameter, and judging from fallen trunks the age of these swamps is many centuries. It establishes the fact beyond a doubt that the white cedar has been growing in south Jersey for ages, and that it is perfectly at home there in every sense of the word. The wood of many of these buried logs is sound, and light. These were dug out, sawn into billets, and split by hand into what were called "mud-shingles", which last for many years.

Mining of
Cedar.

"Mud-
shingles".

In "mining" cedar logs a great deal of skill and experience was required. Of course, many of the trees in the swamp were worthless when they fell. The person in search of shingle logs

therefore first sounds the swamp-bottom with an iron rod. When he finds a solid log, he notes its position, size and length. With a sharp spade and axe he cuts down to it in order to secure a chip of it, from which he is able to tell, especially by the smell¹⁾, whether it was uprooted by the wind, or broken off above the ground. In the first case it is apt to be much sounder and better. If satisfactory, he digs a trench along its length, and saws it off at both ends. The hole he has dug soon fills with water, and, after the log has been completely loosened, it rises and floats, being surprisingly buoyant. It turns over also, at the same time, being lighter and fresher in appearance on the underside. It is then rolled out of the bed where it has rested many years, is sawn into proper lengths and split into shingles. There is still no doubt, buried cedar in the swamps of south Jersey, but although fine in quality, it requires so much labor to work it, that it is no longer profitable.

It seems strange that the mining of cedar, when wood was plentiful, should be more profitable than at present, when white cedar is scarce and poorer in quality. Lumber is cheaper in parts of Eastern America today however than it was a quarter of a century ago. This is due to the fact that a much wider field has been brought into competition by the development of railroads, and special longdistance freight rates from regions where timber is still plentiful, and where very complete, labor saving, wholesale methods of working it, are in practice.

Production
of Tar.

The production of tar was not very extensively developed, and lasted only for a short time. The existence of the industry was due to the peculiar exigencies of the times. During the civil war, the North was deprived of necessary naval stores, for which the ship chandlers were willing to pay enormous prices. The natives of southern New Jersey took advantage of this opportunity, and collected large quantities of "fat-pine-knots", out of which they manufactured tar.

Fat-pine-
knots.

Hoop Poles.

At one time the splitting of hoop poles for barrel hoops was an important industry. Even today a few bundles are prepared, now and then. Coppice oak was used for the purpose. Owing to the substitution of bags for barrels and iron for wooden hoops, there is practically at present no demand for hoop poles.

Minor pro-
ducts.

Winter green (*Gaultheria procumbens*) was once collected, from which the oil of winter green was extracted, and at one time many people found employment in gathering the leaves of the upland sumac²⁾. These were ground at the

The odor of
Cedar chips.

¹⁾ The odor of a chip from a tree uprooted by the wind is stronger than that from a tree broken off by the wind. The former may be perfectly sound while the latter is very apt to be rotten.

Tanbark.

²⁾ The chestnut oak (*Quercus Prinus*) furnishes the best tanning material of eastern trees. It is hardly safe to recommend the planting of trees for tanbark owing to the fact that other means of tanning are

mills, and were used for tanning. Oil was extracted from the wood of the red cedar¹⁾ and sassafras²⁾. In New Jersey one company attempted to make paper from pitch pine wood another, linoleum from oak leaves, but both were unsuccessful.

The principal industries of the present are the cutting of wood for fuel, and the working of timber for constructive purposes. Several minor products of more or less importance are also collected.

Forest
Industries of
the Present.

Wood for fuel may be divided into two classes, polewood and cordwood. When small-sized trees are cut in the pole stage, such as oak coppice, they are merely stripped of their branches, and are not divided into regular lengths, and are sold as pole-wood, which is consumed locally, and bought and sold by the one-horse or two-horse wagon-load. This wood is abundant, and has little worth. If killed by fire, as is often the case, it is not seriously injured for fuel, although slightly charred, and often disagreeable to handle. Large quantities of this wood may be had for the asking. The person who sells pole-wood usually receives little more than his labor is worth in cutting and delivering it to the purchaser.

Wood for
Fuel.

Cordwood³⁾ is cut into sticks four feet long, and split once. It is usually either pure pine or oak, sometimes mixed. If located near a railroad or along a good wagon road, there is a slight margin of profit in this wood. In many parts of the Coastal Plain of New Jersey it has no worth, because the cost of cutting and transportation is equal to, or even more than the market price. Often however, if the owner has teams of his own, he cuts the wood when slack of other work, and transports it in order to furnish himself with labor. His woodland really has little intrinsic worth⁴⁾. It is merely a means to an end. It

Cordwood.

in the process of development and new and perhaps better methods are liable to replace the old. There are a few people however who believe that oak-bark will beworth more a few years hence. The use of Quebracho from South America has had an important effect on this industry but quebracho wood and hemlock will not last forever. This oak is common in South Jersey and one should have no hesitation in planting it. It grows fairly well in the shade of pinetrees.

¹⁾ Cedar oil is still extracted from the sawdust and shavings of the mills in Florida. I have heard that in England a moth-proof paper has been manufactured out of the waste of the pencil factories.

Cedar oil and
Cedar paper.

²⁾ In the south the roots of the sassafras are cut into bits from which the oil is extracted, one thousand pounds of chips yield one gallon of oil. It is used as a flavor and perfume. It is worthy of note also that the word sassafras is a French or Spanish corruption of the word "saxifrage" Sassafras was carried in large quantities to the old country in early times. The term saxifrage means "stonebreak" because it was once regarded as a cure for calculus.

Sassafras oil.

³⁾ A cord is four feet wide, four feet high and eight feet long. It contains eight cord feet or one hundred and twenty-eight cubic-feet or 3.62 cubic meters.

Cord.

⁴⁾ A few years ago wood was sold in Philadelphia from South Jersey for the purpose of dry distillation. There are several establishments

Dry Distill-
ation of
Wood.

pays however, to convert the straight limbs and tops of trees, from which sawlogs have been cut, into cord wood. South Jersey has to compete in the production of cordwood with the wood land along the rivers of the neighboring states of Delaware, Maryland, and Virginia, where a large negro population exists, which is skilful with the axe, and willing to work for small wages.

The axe.

In the felling and conversion of trees for fuel in southern New Jersey the axe is the only implement used. It varies in weight from four to seven pounds with a helve two and one half feet in length more or less. The edge of the axe is rounded and the sides of the blade convex. This convexity prevents jamming and sticking and pries out and scatters the chips. Point by point the axe has improved until it is now the most perfect and useful of implements, and an excellent illustration of the fact that tools with graceful lines are usually at the same time of the greatest utility. The axe must be properly "hung", that is, carefully adjusted and balanced to the handle, so that it suits the person who uses it. The helve should be hand-made, of white oak, or hickory, properly curved, pliant, strong, straight with the grain and smooth. Wood cutting is an art, or as the woodmen say, there is a "sleight" or "nack" about it. Some men who appear to be working no harder than others, cut three times as much in the same length of time. Many of these backwoods men have handled the axe from childhood. They can drop a tree with ease wherever they wish, cut right or lefthanded, leave a smooth clean sloping or roof-shaped top to a stump when so disposed, but they are paid by the number of cords or the logs they cut, and what they do, therefore, is done in the easiest and quickest way.

In the hands of a blunderer the axe is capable of irreparable damage. Uneven or "fox-eared" stumps are the marks of the novice. From the landing of the settlers to the present, it has been slashing. The bulk of the forest which remains, consists of culls and forest weeds, but by careful selective cutting it is still capable of rejuvenation. In fact, with an exact knowledge of the conditions which obtain, and the manner in which the different species disport themselves under varying circumstances, it is even possible to restore it by the judicious use of the same implement which in the hands of the careless cutter has almost caused its extinction.

of this kind in neighboring states. I fail to see why this industry could not exist in South Jersey as well as elsewhere. Fernandez recommends it for India. It as an industry which would use the rough wood, for which there is no market and which rots in the forest. According to "The Country Gentleman" it pays to convert hardwood which cannot the otherwise used into ashes for fertilizer. If this is so still more profitable must be the industry which yields ashes and charcoal besides a valuable distillate.

Although fuel is plentiful in South Jersey, good cedar and pine saw-stuff is scarce and valuable. After trimming the tree which has been felled, and converting the branches into cord-wood, the bole is divided according to its crooks. Logs are cut therefore into all lengths in the woods, from ten to twenty feet or more¹⁾. Sometimes if the logs are very large they are swung under the axles of wagons with high broad-tired wheels. They are usually loaded by means of skids, canthooks and horse-power, as is common in Germany.

Wood for
constructive
Purposes.

Some of the saw mills, which were formerly much more active, are very complete, but the majority are simple in nature and only work lumber for local demands. The modern American portable mill, which leaves desolation in its wake, is common. In parts of Eastern America, where waterways admit of it, these mills are placed upon flatboats, and moved with ease to the timber, instead of the timber to the mill. The simplest mill usually possesses two circular saws, one, small, for shingles etc., and another, large for boards, beams, joists, posts, studding, sills, rafters etc. The log is firmly placed on a quick moving carrier, controlled by a lever, and squared. Four bark covered pieces called "slabs", are first sawn from its sides, after which it is cut into whatever the sawyer desires. Slabs of the pine, and saw dust are used for fuel in the steam mills. Good slabs are sold and used in the construction of buildings, fences etc.

Portable
saw-mill.

Slabs.

There is no rafting in this region, the logs are transported either by wagon or boat. The roads are generally good — even the sand roads are not bad in winter. The construction of roads in such a level country with an abundance of good gravel is a simple matter. When they become flat and uneven, more gravel is added. By means of the scraping-machine they are kept in shape. Shell roads along the coast are not uncommon. In swampy places, pole or corduroy roads are constructed, and saw dust and bark are sometimes placed in the ruts of sandy wood roads.

Roads.

The income from the gathering of wild fruits is probably equal to, if not more than the yield from fire-wood. The most important of these are the cranberry, huckleberry, and blue berry.

Minor
Products.
Wild Berries
and Fruits.

¹⁾ A log is measured by what it will square. The unit is one foot, board measure, which is equal to 144 cubic inches or 2360.16 cubic centimeters, that is, a piece of wood twelve inches square and one inch thick. A log is usually measured as follows:

d = diameter of log at small end in inches. $\frac{d}{2}$ = radius. $\frac{d^2}{2}$ = area in square inches of the end of the largest piece of timber it is possible to cut from the log. l = length of log. $\frac{ld^2}{2}$ = contents of stick of timber in cubic inches. $\frac{ld^2}{2} \div 144 = \frac{ld^2}{288}$ = number of feet board measure in log.

The common
method of
measuring
logs.

The
cranberry,

The cranberry (*Oxycoccus macrocarpon*¹), which was wild a few years ago, is now extensively cultivated. It keeps perfectly throughout the winter, and forms a rich crimson sauce, which is relished with turkey. Large quantities of these berries are exported to other states, and even to foreign countries.

The high-
bush blue-
berry.

The high-bush blue-berry²) (*Vaccinium corymbosum*), which reaches perfection in the swamps of South Jersey, has never been cultivated. It is preferred by many to all other wild fruits. It reaches the dimensions of a large shrub, if not a small tree, on rich, moist, loose soil. The quality of the berries can be easily improved by trimming. The natives know this and accomplish it in a drastic, wholesale fashion by firing the woods. The young shoots which spring up after a fire, bear large luscious berries.

Wild grapes.

The wild grapes are also abundant. The fox grape (*Vitis Labrusca*), is plentiful in the swamps, the vines of which often form luxuriant tangles in the tops of the trees. The fruit is dark purple or amber in color, with a tough pulp, but delicious musky aroma, and famous for jelly.

Persimmon.

The persimmon tree (*Diospyros Virginiana*) bears an abundance of rich fruit. The word "persimmon" is from the Indian, meaning "choke-fruit" because of its astringency when not perfectly ripe. The improvement of this fruit by grafting has begun. It will no doubt soon equal the delicious persimmon of Japan. At present, when a little green, the fruit is puckery; when ripe, too soft; it is too small and has too many seeds. It contains a larger amount of nutritive matter than other fruits, and is excellent for pies and puddings. The tree is sometimes monoecious, sometimes dioecious.

Beach plum.

There is no more promising wild fruit for cultivation, than the beach plum (*Prunus maritima*). It grows in sea-sand, close to the ocean, and in the driest, most inhospitable places, and at the same time bears a large crop of plums, which are excellent in flavor. It is only a shrub, but well worth planting in sandy regions. In addition to the above fruits there are many others of more or less importance for food, flavors and wines.

Sphagnum
moss.

The floor of a cedar swamp is usually covered with a mass of sphagnum moss. This is collected, baled in hay presses, and sold to nurserymen for packing purposes. This material is remarkable for its ability to retain moisture and is extensively used in the shipment of trees and plants.

The terms
cranberry
huckleberry
and
blueberry.

¹) The term "cranberry" is properly restricted to the genus *Oxycoccus*, the term "huckleberry" to the genus *Gaylussacia*, and the term "blueberry" to the genus *Vaccinium*.

²) White or pink varieties are not uncommon, which are simply cases of albinism. These are very sweet and worthy of propagation.

Large quantities of holly, mistletoe, cedar etc. are sold in the cities. Many thousands of the most beautiful and symmetrical young conifers are sacrificed annually for Christmas trees. If the trees were raised for this purpose it would be a perfectly legitimate business, but the Christmas tree gatherer, in order to secure extra fine specimens, cuts the tops out of large sized red-cedar trees.

Evergreens
and Christ-
mas trees.

Many flowers, especially those of *Magnolia glauca*, are collected in large quantities and sold.

The cultivation of the willow is in its infancy in New Jersey, and will be referred to more at length in another chapter. The wood of the white oak (*Q. alba*), when split into thin slivers, is an excellent basket material. There baskets are strong and durable. The common American market-basket¹⁾ is not woven. It is extremely cheap and simple, and goes with the contents.

Basket
materials.

The basket tree of the south, however is *Quercus Michauxii*, the basket, or swamp-white oak. This tree is very closely related to *Quercus platanoides* if not a southern form of the same. It grows in the swamps of South Jersey but is not abundant. It is one of the most magnificent trees of the oak family. A few years ago it was plentiful on rich southern swamp bottoms. Its wood is of very fine quality for constructive purposes, and possesses a peculiarity which especially fits it for basketry. Each annual ring may be easily separated in the form of a thin flexible strip of great pliability and strength. The thousands of baskets used in the cotton fields of the South were woven from ribbons of this wood, together with the facts that it requires rich land, and does not reproduce itself freely is about to cause its extermination.

The basket-
oak.

There are many plants of more or less value medicinally. Perhaps the most important, which is common throughout the woods of the E. Carolinian Zone, but rare in New Jersey, is the witch hazel (*Hamamelis Virginiana*), a fluid extract of the twigs etc. of this plant is a famous lotion for allaying inflammations. It is used by everybody for the ills of both man and beast. It is a peculiar shrub, with several branching crooked trunks, about ten feet in height. Its pale yellow flowers bloom late in the autumn when the leaves are falling, and the woody capsule, which explodes and scatters its two black shining

Witch hazel.

¹⁾ The American market basket, which is used by almost everybody, is simple and cheap. In one place in South Jersey these baskets are manufactured. It is almost the shape of a truncated cone, the small end of which is the bottom, which is usually a round piece of pine board. Upright slats are nailed to this and held in shape by a rim in the centre and at the top. These slats are manufactured out of bilsted billets with the veneer-cutter. The log is rotated against a long knife, the two being drawn gradually together until the billet is too small. The extensive use of this basket has lessened the demand for woven kinds.

American
Market
Basket.

seeds, matures the following summer. It grows well on the poorest kind of gravelly soil.

Mushrooms. The woods are full of mushrooms, many of which are edible and nutritious.

Mast. Acorns are abundant and are fed to swine. There is a fair crop almost every year, and an immense crop every now and then. Turkeys which thrive on dry, sandy soil, feed on the acorns of the scrub-oak. Black walnuts contain rich food material and are used by confectioners. Hazelnuts grow well in the swamps, having escaped in several places from cultivation. The wild chestnut thrives in the moist sand of South Jersey, and although the nuts are usually small, they are very sweet and abundant. In addition the collection and careful preparation of the seeds of important forest trees would yield ever increasing returns.

Nuts.

Pine-chats.

I have yet to mention forest litter, especially the collection of "pine-chats" or leaves, which in many pine regions plays a very important and peculiar rôle.

Forest litter is extensively collected in Southern New Jersey for the bedding of animals and as fertilizer for sweet potatoes; in fact, fair crops of this staple food material may be raised on extremely sandy soil, without other manure.

Collection of
litter on the
Chesapeake
Peninsula.

It is however, south of New Jersey, on the peninsula between the Chesapeake and Delaware where the litter is most assiduously collected and used. The conditions which exist there are peculiar and instructive to those interested in the amelioration of pinelands. In fact, it is the demand for forest litter which in a great measure has prevented forest fires, and impressed upon the natives the value of their forests. The region reminds one of the Medoc, and the fields of young smooth-bark-pines (*P. echinata*), the blocks of the Maritime pines along the shores of Gascony. Almost every farm has its pine forest. These, of course, are of all sizes, and ages, varying from fields as thick and dense as grain, to forests fit for large-size timber. There are few signs of forest fires.

The soil is light and sandy, dune-like in nature, along the shore, to which the pines grow close, although a few have been killed here and there by shifting sand. The natives recognize the value of the forest in holding the soil in place, and in protecting their truck patches from the force of the wind, which would naturally at times sweep over this narrow peninsula.

On entering one of these forests, one observes at once, that although there are many small trees of holly, and bushes of sweet gale, the ground is free from litter and brush. If one happens to visit the region at the proper season he will see men and women, raking up the forest litter. Very early in the Spring, or late in winter, one can see field after field covered with pine-chats, to be ploughed under, just as soon as the

weather permits. In fact the fields are laid out in squares, by means of the plough, in order that the pine chats may be easily measured, and thus evenly distributed. Just as soon as a field becomes worn out, it is abandoned; the adjoining woods furnish the seed, the wind sows it, and soon a fresh growth of pines appears. Here and there throughout the forests there are avenues, which although constructed to facilitate the collection of pine chats, serve at the same time the purpose of fire-lanes.

Because of the value of the pine-chats, the forest floor is free from inflammable materials, just at a time when fires are most likely to occur. The removal of this debris may be contrary to the principles of German forest management, because it naturally impoverishes the forest soil. In the course of time however, many of these potato fields are allowed to come up in pines, and fresh fields are cleared when the pines have been cut.¹⁾

Effect of
removal of
litter.

Another point of great advantage is, that the forest is not continuous, but cut into parcels, with farm lands and glades intervening. In fact it is a land of thrifty forests without foresters, and practically without the need of forest laws.

For private holdings of pine lands, I am inclined to favor this method of management, under the peculiar conditions existing in certain parts of America. In this way the forest constantly yields, indirectly, an important income. It is simply a rotation of crops, of which the pine is the most important, producing throughout its whole life a material, which to the farmer of the Eastern shore of Virginia is of more value than wood.

It is easily seen, from the condition of the forest industries which have just been described that the Coastal Plain of New Jersey has passed through the first and most lucrative stage of its existence. The time is at hand for the establishment of industries with permanency in view. The most important step in the right direction would be the protection of its wood lands, game, fish, oysters and clams, which were once so abundant.

Establish-
ment of
Permanent
industries.

¹⁾ Unlike other crops, the forest constantly improves the soil, provided the litter is not removed or allowed to burn. The roots of trees penetrate to its deeper layers, and absorb large quantities of mineral matters. A large percentage of this material goes to the leaves, and is deposited on the surface. The surface soil is both enriched by these mineral substances and protected by a mulch of humus in varying stages of decomposition. As the lower layers rot, new layers of leaves and twigs are being constantly deposited, so that the forest soil, in the course of time, fairly reeks with nourishing plant-food. It has been shown without doubt that the removal of litter from poor soils is ruinous. It is like stealing food from a starving man. The removal of forest litter from rich soils is indeed however a very small matter and it is doubtful if it really does any serious injury.

The removal
of litter.

Chapter III. Forest Protection.

Protection
against Fire.

The difficulty in extinguishing fires under the peculiar conditions which exist in the pine woods of America is indeed great.

Before the great fires of Minnesota in the late Summer of 1894, the dead material became so dry, that when pulverized and sprinkled in a flame, it would ignite with an explosive flash. Add to this a hot dry wind, an air filled with combustible dust and gases produced by many smouldering fires, and it is easy to appreciate the hopelessness of extinguishment.

The forest fire question belongs to the sphere of law and order officials. It is more a matter of morality and justice, than forestry. If the efforts which have been expended in the extinguishment of fires in times past, had been exerted in the formation of means for their prevention, the country would be covered with forests, with a fertile soil.

Duty of the
State.

I shall have very little to say in reference to the duty of the State. The subject is too long and complicated. Unquestionably every state should purchase and care for, irrespective of financial profit, all lands which private parties¹ cannot pro-

Private
forestry.

¹) A private forest does not always mean a neglected forest and a short rotation. Many rich families in Europe gladly avail themselves of this sure and permanent way of investing their fortunes, which pass from father to son, as do the date-groves of the East. In America the railroads, express, telegraph and telephone are private. The finest institutions in America are due to private enterprise. Great public reforms are usually brought about by the energy and influence of a few public spirited people. After all, what is the state in America? It is simply an organized community, the ruling powers of which are only persons which the people have chosen temporarily from their midst. The purchase of forest land, the management of forest land or the sale of forest land depends upon what the majority of legislators may think best and they in turn are supposed to comply with the wishes of the majority of their constituents. The personnel of the legislature is constantly changing, so that the management of forest lands owned by the state would be subject to many vicissitudes.

The State in
America.

On the other hand one can find in America a precedent for almost every thing. The ownership and management of the Hot Springs of Arkansas, for instance, savors of the extremest paternalism. As early as 1832 an act was passed by congress constituting these Springs as a "National sanitarium for all time" and "dedicated to the people of the United States to be forever free from sale or alienation". The reservation and Springs are in charge of a Superintendent appointed by the Secretary of the Interior. There is also however a free bathhouse for those who cannot afford to pay. — The profits are used in beautifying the region. There are no reasons why forests in the neighbourhood of famous resorts should not be similarly owned and treated.

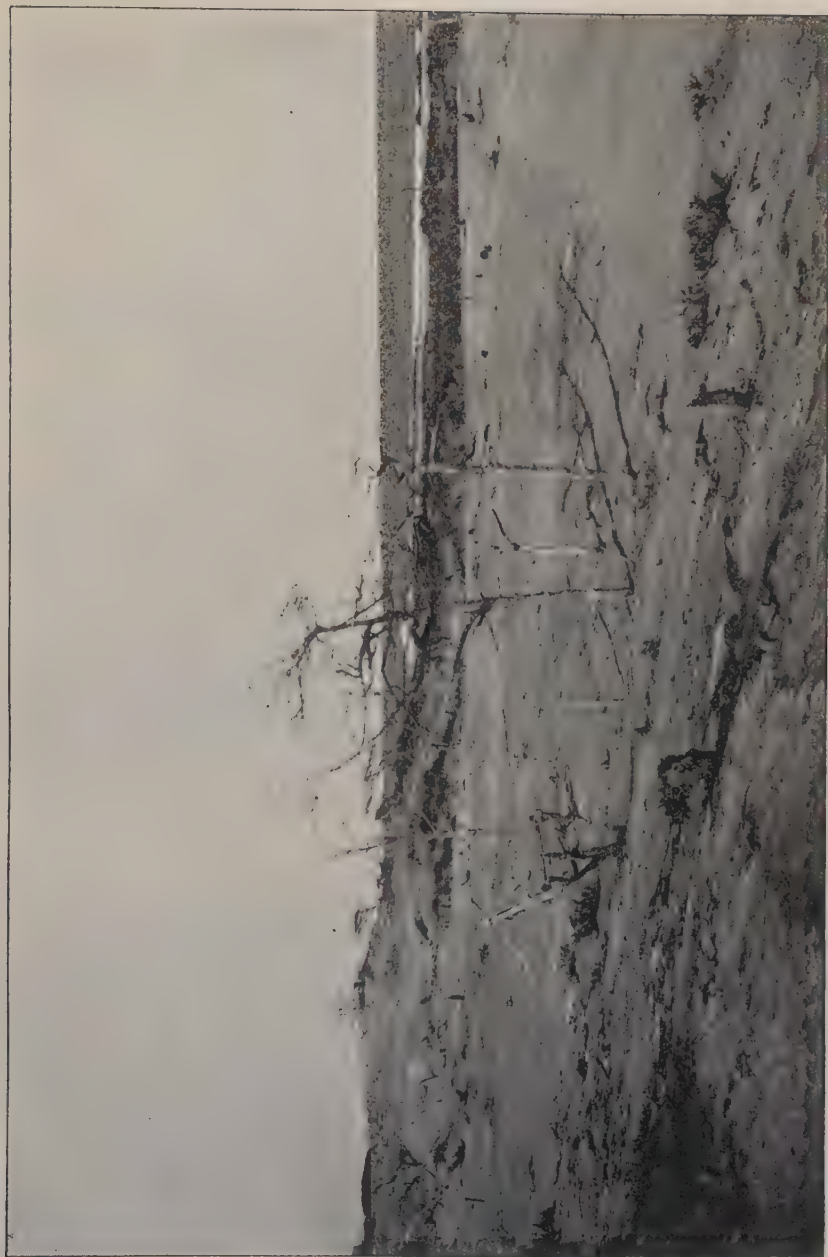


Plate III. The Dune near Avalon - the seaward side, showing the gnarled trunks of trees which have been engulfed and killed and then again exposed.

perly manage, the forestation of which is necessary for the protection of other more valuable lands¹ from the destructive forces of nature, and should apprehend, convict, and severely punish all persons, or corporations, guilty of criminal carelessness or maliciousness with fire. If however the State of New Jersey would simply protect the properties of private parties against incendiaries and careless firesetters there would be few fires.

Incendiaries.

The "fire season" in New Jersey begins about the middle of March, and continues with more or less fierceness until the end of October. Sometimes, only the thin leafcovering of the soil is burnt, and little damage is done (surface fires); sometimes, the deep, dry muck of the swamps burns for many days (ground fires), and sometimes the fire sweeps through the crowns, (crown fires), but often, the surface, crown and ground fires are one, roaring and rushing irresistably with the wind, with miles of front, until stopped by a lack of food material, a fall of rain or a stream of considerable dimensions.

Fire season.

About fifty percent of the fires of the Coastal Plain of New Jersey, are caused by sparks from locomotives, ten percent, are set by incendiaries for evil purposes, ten percent are set purposely to improve the berry crop or pasturage, and the rest are accidentally and carelessly set.

Cause of fires.

The effects of fire are practically the same all over the world, impoverishment of soil, destruction of game and its food supply, unhealthfulness,² increase of insect pests in addition to the loss of wood and other property and injuries to industries.

Effects of Fire.

For the prevention of fire, the punishment of fire-setters and the construction of wide firelanes along all public wagon roads and railroads, are necessary. Railroad companies should

Prevention of Fire.

¹) It is very difficult to say just what lands are unfit for cultivation. Good agricultural soil may often be unfit for trees and vice versa. Even the "Plains" of New Jersey would if properly treated produce choice grades of grapes berries and sweet potatoes and perhaps other fruits. In North Jersey the choicest peaches are produced on what is apparently the roughest and most inhospitable soil. Many Italians have thrifty fruit farms on extremely sandy soil in the southern part of the state.

Wasteland.

²) I believe the malarial condition of our south is due to the ill-treatment of forest lands and the formation of stagnant marshes in consequence. It is a noteworthy fact that the Dismal Swamp of Virginia and North Carolina is free from malaria and perfectly healthy while the adjacent fire swept pinelands are famous for their unhealthfulness. Just as the Landes of France were rendered healthy by tree growth and drainage so is it possible to improve the sanitary condition of the Atlantic Coast Region.

Tree-Growth and Healthfulness of Swamp and Pinelands.

Only reflect that the leaves of a medium aged beech forest, if spread out, would cover eight times the area that the growth in question occupies, and it will be quite apparent that even in the hardest downpours almost one-fifth of the water is intercepted by the foliage, and thence flows slowly down the trunks or passes off in vapor.

Then, too, immense quantities of water are transpired by the leaves, often, as with the eucalyptus, several times the amount which falls on the surface it occupies.

Fire lanes.

be required to construct lanes, broad and clean enough along their tracks, to eliminate all danger from flying sparks, to ditch all swamplands to water or sand, on the outer edge of the lane, and to constantly use efficient spark arresters on their engines. The townships should be required to construct similar lanes along all public roads. In this way, what are now points of danger, from which the majority of fires start, would become avenues for the prevention of its spread, and would serve, at the same time as vantage points in combatting it. Whenever possible, these fire-lanes should be kept under cultivation, in other places the brush¹ should be cut, and all combustible materials burned at a time when there is no danger of setting fire to the adjoining woods. The usual method of extinguishing extensive fires is by "back firing" or "counter firing". This is however dangerous work, and should not be attempted save by those who are experienced and capable. I know of many instances, where the back fires, set by inexperienced, excited persons not only resulted in exceedingly disastrous conflagrations, but rendered the skilful work of others of no avail. For the extinguishment of surface fires, shovels, sand, and hard work are usually sufficient. Fortunately sand is everywhere plentiful, except in swamps. It is often possible to beat out surface fires with a green bough or bush. In the extinguishment of ground fires or those which burn in the peat of swamps, it is necessary to confine them within certain limits, by digging deep trenches.

Extinguish-
ment of
Fires.

Formerly charcoal burners set fire to the forest in order to be able to purchase it cheaply, by rendering it unfit for any other purpose than coal wood. The charcoal industry is done, but the natives still fire the huckleberry-bush to produce fresh shoots on which finer berries grow. Berry picking is an important industry, and the occurrence of such fires is common. But the darkest side of the whole subject is the problem of how to compel rich and politically powerful railroad corporations to observe the necessary precautions in crossing a country in which they have little interest.

Inter-
spersion of
farms and
forests

The main differences between the conditions existing in Southern New Jersey, and the peninsula between the Chesapeake and the Delaware, are, that the forest land there, is cut into

Forest Fires
on the
"Esterel".

¹ The "Esterel", a region of France not far from Cannes, is famous for the elaborate fire measures which are in force there. It is a mountainous district, thinly covered with pine and cork-oak and extremely susceptible to fire which causes great havoc when the very violent wind called mistral blows. I visited it a few years ago and was surprised to find that in addition to the formation of many firelanes, the removal of underbrush, observation posts, telephone, perfectly organized patrols etc., that they burn over patches of the surface every year from December to February with the object of preventing the growth of weeds and underbrush and the accumulation of combustible litter. Little by little the whole area is burned over in this way.

many small blocks between which is farm land, and that the proper sentiment exists in the minds of the natives, a sentiment due to the value of the pine chats.

I believe therefore that the division and sale of this land in small blocks, will, in time lead to its amelioration. This process is in fact already in rapid progress. Every year, this region is brought nearer to the great population centres of the East, by improvements in roads and other means of transportation.

One of the most serious consequences of fires is the increase of insect pests which they undoubtedly occasion. When the equilibrium of Nature is destroyed, obscure species appear, and become obnoxious, while others, owing to a change of conditions, change their habits. As soon as a tree becomes weakened by fire, or other cause, it falls an easy prey to woodboring insects.^{1 & 2)}

It is of course impossible in this connection to even enumerate the most destructive insects. I shall only mention *Cyllene Robiniae*, the locust borer, a serious pest to *Robinia pseudacacia*, which has been extensively planted by the farmers in Central and Northern New Jersey for fence posts. It was indeed fortunate for Europe, that when the locust was introduced, this pestiferous insect was not imported with it. In Europe, it is a beautiful shade and ornamental tree; in its native land, owing to the depredations of this insect it is usually scraggly and unsightly. The trunks and limbs are sometimes completely honeycombed by this insect. If the trees are watched in August and September, one is likely to find handsome brown and yellow banded, wasp-like beetles, laying oval, dull white eggs in wounds and crevices of the bark. In about ten days these eggs hatch and the larvæ bore into the tree. They are still small by winter, during which time they lie dormant in the

Division of
land in
blocks.

Protection
against in-
sects.

Locust borer.

¹⁾ In Gascony seeds are sown with those of the maritime pine to attract insectivorous birds, the efficacy of which however is doubtful.

While visiting the Dunes of Holland I was told that hens were successfully used to combat an insect which devoured the sedge which held the sand. They were kept on the dunes in large quantities and as early as three o'clock in the morning were actively at work. I was also told by several willow growers in Europe that when their plantations become infested with insects they simply let in their chickens which soon devour the bugs.

One of the most beneficial fowls in this respect is the turkey, especially if it is the result of a cross between the domestic turkey and wild gobbler. Certain breeds of chickens soon become satiated and refuse to wander from their homes. The Buff Leghorn fowl is one of the most active foragers and with plenty of range can pick up its own livelihood throughout a large portion of the year.

²⁾ In the dense shade of the primeval woods there was a small number of birds and many of these were predatory in nature. With the cutting away of the forest the meadow, field and social birds became abundant. (See *Indiana: A century of Changes* by A. W. Butler.)

The sowing
of seeds to
attract birds.
Hens on the
Dutch dunes.

Social birds.

wood. In the Spring they begin to bore, until about August when they stop feeding and enter the pupæ stage, and a week or so later appear as full sized beetles. These beetles live upon the pollen of the golden-rod (*Solidago*), which is everywhere abundant at that time, and, although a beautiful flower is never the less an objectionable weed.

The outermost-trees are usually completely riddled, while those in the centre of a group may escape altogether. It seems to suffer less also, when mixed with other trees. A coating of soap (lye, fish-oil and water), just before the beetle lays her eggs, is, for the season efficacious, but troublesome to apply. Although these insects are very abundant and seriously injure the wood and impair the vitality of the tree, it is still fit for fence posts, for which it is almost exclusively used. This insect infests healthy trees, growing on rich soil, but the proportion of trees in a plantation which is thus seriously injured is not sufficient to discourage the propagation of this unique and extremely useful tree.

Fungous
pests.
Cedar apple.

Much could be said of fungous pests, which, although abundant are not as serious as insects. I shall only mention the cedar-apple (*Gymnosporangium macropus*), which is common throughout the state, and which is of special interest because it leads a dual life, one phase of which is on the red-cedar (*Juniperus Virginiana*), and the other has the cultivated quince, apple and their allies for its host plants.

On the twigs of the cedar it causes brown, irregularly lobed excrescences, as large as chestnuts, over the surface of which there are slight indentations or centres in which the teleutospores are located. These spores are thick walled, brown, two-celled bodies, which in warm, moist spring weather, germinate, that is, the cell-wall breaks, and there protrudes from each cell of the teleutospore a hypha or tube on the end of which several small spores or sporidia are formed. All the germinal tubes from one centre adhere together, forming an orangecolored, gelatinous, tentacle-like growth. Several of these gelatinous masses distributed over the surface of the whole excrescence, give it the appearance of a chrysanthemum, a short distance from the tree. Very often, many hundreds of these may be seen on a single tree, and when they are in the height of their germination, are peculiarly striking. The sporidia are borne long distances by the wind to the young, tender leaves of the apple and quince, on which, if the conditions are right, they soon germinate, and produce the other stage of this peculiar disease, which, on its orchard hosts, causes the well-known "rust". Although this fungous does practically no injury to the cedar, "the rust" is a very serious disease, especially in the south. It is more dangerous to quinces than to apples. The spores can be carried by the wind several miles. Although not

wise to plant orchards in the neighborhood of red-cedars or vice-versa, this disease is not of sufficient seriousness to discourage the propagation of the red-cedar in South Jersey, because the apple industry is there of little importance.¹⁾

Injuries to the forest by domestic and wild animals are slight. Mice, rabbits, and squirrels sometimes damage young trees, and rob the nursery of its seeds if not properly protected.

Injuries
caused by
animals.

The mistletoe (*Phoradendron flavescens*), is not a serious parasite. It grows on the sour gum, which is a tree of very little value. Further south it is much more abundant, and in Kentucky and Tennessee it infests and often seriously injures the black walnut.

The mis-
tletoe.

It is the inroads of forest weeds, as with the weeds of garden and field, which are capable, either directly or indirectly of doing incalculable damage to valuable trees.

In the swamps of South Jersey, clambering vines and worthless briars and bushes often have complete possession of the soil. The various species of grape which mingle with the branches of trees hinder, of course, their growth, but, owing to their beauty and the value of their fruit, their presence is not so odious. It is quite otherwise with the poison ivy (*Rhus toxicodendron*) which firmly clasps the roots, trunks and branches of trees, and is poisonous to the touch. The swamp sumac (*Rhus venenata*) which is a shrub, and often almost a tree²⁾ is abundant, and is also poisonous, causing a distressing dermatitis, which is often accompanied by serious illness. Another class of extremely disagreeable weeds, are the climbing, prickly briars of the genus *Smilax*. The most provoking feature of these weeds, is that when their rhizomes have once gained possession of the soil, it is well nigh impossible to eradicate them. Clothing and skin are torn in handling them, burning only causes them to sprout with fresh vigor, and, if left alone, they soon reach the tops of trees to which they become inextricably attached. The only way to get rid of them is to cut them down with a bush hook or machete, and then with a grub hoe, dig up their rhizomes, bit by bit, and year after year, until their extermination is complete.

Forest
Weeds.

Vines.

Poisonous
plants.

Briars.

¹⁾ The „Hexenbesen” or witches broom (*Exoascus Cerasi* [Juckel] Sadeb.) which has reached America from Europe may be seen now and then on species of *Prunus* especially *P. serotina*. It is by no means a serious disease and seems to have little tendency to spread. The owners of orchards of the cultivated cherry should remove and burn the brooms from the wild cherries which may be in the neighbourhood.

The Hexen-
besen in
America.

²⁾ Dr. Fernow defines trees as follows: Trees are woody plants the seed of which has the inherent capacity of producing naturally, within their native limits, one main erect axis, not divided near the ground, the primary axis continuing to grow for a number of years more vigorously than the lateral axes, and the lower branches-dying off in time.

Definition of
a tree by
Dr. Fernow.

Chapter IV. Sylvicultural Prospects and Suggestions.

I shall only recommend the cultivation of those species which without doubt reach their optimum in the Coastal Plain of New Jersey, which are easily propagated and tended, for the wood of which there is a likelihood of ever increasing demands, and to which a system of short rotation or revolution may be successfully applied.

Although the use of wood in America is too often guided by fashion, there are many kinds which will always hold their own. The white oaks, hickories, walnut, chestnut, and others, produce wood for which there will be a demand as long as wood is used, and although they thrive in the climate of South Jersey, are not at home in dry barren sand. Their cultivation should not be attempted unless the soil is at least of medium quality. For shade and ornament they are always worthy of the first place, and should be planted in spare corners, and in small groups, in pastures on fertile soil on every farm.¹⁾

Species
adapted to
Waste lands.

I shall only mention therefore a few of those species which will grow well, and produce useful timber on those inhospitable soils to which the forest of South Jersey is destined to be relegated. They are the smoothbark pine (*Pinus echinata*), the red cedar (*Juniperus Virginiana*), the black locust (*Robinia pseudacacia*) for the upland, and the white cedar (*Chamaecyparis thyoides*), for the swampland.

Subsidiary
sorts.

Other trees which may be classed as secondary or subsidiary sorts, and which, under certain circumstances, are worthy of encouragement, are, chestnut-oak (*Quercus Prinus*), sassafras, holly (*Ilex opaca*), bilsted (*Liquidambar styraciflua*), brewster (*Magnolia glauca*), red maple (*Acer rubrum*), and wild cherry (*Prunus serotina*).

Sylvicultural
Methods.

The sylvicultural methods which are best, vary with the quality of the locality, and are dependent upon many conditions. What may be considered best for one place, or one man, may be bad for another. For instance, a pine forest from which the

The Marl
Region.

¹⁾ The soil of the rich agricultural region which extends across the state and which borders the Pinelands, in fact tongues of which project into the Pinelands, is a fine sandy loam in which the whitepine, oak, chestnut, hickory, walnut, beech, tulip tree etc. thrive. There are also in this agricultural region large beds of marls which are extensively used as fertilizier.



Plate IV. A swamp, the trees of which although not consumed have been killed by fire forming a mass of decaying wood in which many sorts of pestiferous insects breed.

litter is constantly removed, is, from the European stand point, robbed and impoverished. This is true, but a forest without litter is better than no forest, and if the removal of litter insures its existence, it is proper to encourage its collection.

From a silvicultural stand-point progressive land-owners in New Jersey may be divided into three classes: Those who possess forest land which they may wish to improve, those who desire to plant old fields, bushlands and cut-over-lands afresh, and, those who possess forest farms on which they live, and out of which they must earn a livelihood. Very often these three are one.

Classes of
landowners.

If a party possesses woodland, even if sparsely stocked with inferior kinds, and cannot afford, or may not desire to plant afresh with better species, but wishes to gradually improve it, the best system to apply is what the Germans call "Femel¹⁾ betrieb" or "Plänter-betrieb" and the French "Jardinage". There are many large forest owners in South Jersey, who are able to employ a forester, but, who cannot afford the cost of extensive plantings. These large land holders employ managers, who are practical men, but with little knowledge of forestry. The most practical system for such tracts is "jardinage". It is by far the best for a new country; where the demands for wood are less than the supply, and where a system to be popular, must yield enough constantly to pay all expenses, taxes and a little besides. It is an excellent system for cooperative associations and corporations, which have other objects in view, such as the protection of game, or water supply. It is extensively practised in India where it is usually known by its French name "jardinage". It is not confined to new countries however, and is even the favorite method of many European foresters of treating protection forests. It may be seen in a very high state of development in parts of the Black Forest.

Jardinage for
large wood-
land owners.

¹⁾ It has been said that the term "femel" is from the Latin *felmella* or *femina* and was applied to this system of forest management because of the custom of pulling out the male hemp plants and leaving the females to mature their seeds and to be harvested later. This explanation of the term however is wholly unsatisfactory and probably incorrect. The English "fimble-hemp", in German "fimmel-hanf", is applied to the male hemp-plants and to short or undeveloped females. The German words *fimmel*, *feime*, *fimme* and *fehm* probably all mean or meant stacks, cocks or piles of grain, hay etc. The term "fehm" was also applied to mast, "fehmgeld" meant pannage and the verb "fehm" meant to turn swine upon the mast. It is more than likely that the woods into which the swine were allowed to feed were called therefore *fehm-* or *femelwoods*. The system of silviculture therefore which retains the irregular form of a natural mixed woods with all age classes is very appropriately called the *femelform*. It is therefore proper to name this method the *femel-cutting-system* in contrast to the *clear-cutting-system*. Since the term is an old Germanic word it is better for common use than "jardinage".

The word
femel.

To apply this system, it requires more skill, experience, and intelligence, than the majority of land holders or managers possess. It is however an elastic system, and in its simplest form is practical for land on which there is any growth worthy of the name of forest.

Present
American
methods.

"Jardinage" is about the reverse of what is ordinarily practised in America. In New Jersey, one man may buy all the merchantable oak, on a certain piece of land, another, all the cedar etc. Any diseased trees or kinds without value, are left standing, not for soil protection, but because they are not worth cutting. These are stimulated by the increase of space and light, produce large quantities of seed, and soon have complete possession of the soil. In other instances the land is bought with all that covers it, and stripped of what is merchantable. Covered with slashings¹⁾, it is left to be swept by fire, or to be covered by whatever may happen to grow, or, is sold to land-agents who divide it into many small farms, which they sell to all sorts of new-comers. Sometimes it falls into the hands of speculators, who hold it indefinitely with various purposes in view. In consequence of this mode of treatment, uplands which once produced pine fit for ship timbers are now only bush-lands; swamplands which have yielded choice white cedar are now cripples. The only suggestion of silviculture is the custom of leaving a seed tree here and there. Many of these seed trees were left however, not for the purpose of seeding the ground, but as linetrees to mark the borders of properties. Woodmen deserve the credit, however, of leaving the smooth-bark pine (*P. echinata*) and not the pitch pine (*P. rigida*) for this purpose. Many of the finest bits of forest in south Jersey are due to their presence.

Land Agents.

Land
speculators.

Seed Trees.

Line Trees.

The aim of jardinage is the constant betterment of soil and forest. It prescribes that the soil must be kept covered, and that the most valuable species must always be encouraged. The dead and diseased trees must be removed, also all inferior kinds which are a hindrance to a young, more promising growth. Many minor points the owner or person in charge, must settle. The axe must be cautiously used, and always with a purpose beyond the immediate reaping of a wood crop, and the operator must be perfectly familiar with the peculiarities of the species with which he is dealing. Caution in cutting, and the sowing of seed, or the planting here and there of desirable kinds, will in the course of time bring order out of chaos.

Planting of
old fields and
bush-lands.

In general for those who wish to plant old fields, bush lands, and cut over lands afresh, pure stands with short rotation

Slashings.

¹⁾ The term "slashings" is a very appropriate word which is applied to the small limbs, tops etc left in the woods by the cutters. This immense mass of rubbish is allowed to dry and rot where it falls either to cause disastrous fires or furnish a breeding place for pestiferous insects.

are preferable¹⁾. These are desirable for the small land-holder, because of the ease with which they are established and managed. When forests of this sort are once formed, they are thenceforth easily regenerated, either in the form of coppice, or, if they are species which produce no coppice, from adjoining blocks or compartments. The four primary species which I have already mentioned smooth-bark-pine, red cedar, black locust, and white cedar, are easily propagated, and capable of supplying every important demand.

All forests on upland, should be divided into small sized blocks or compartments, separated by wide, cultivated fire-lanes. If the forest is on swamp land, a lane should be cleared and cultivated on the upland around the swamp.

Pinus echinata formerly *P. mitis*, is the most important pine of Southern New Jersey. It is usually associated with the pitch-pine (*Pinus rigida*), with here and there patches of the scrub pine (*Pinus Virginiana* or *inops*).

Several foresters have encouraged the planting of pitch-pine in New Jersey, because it grows on extremely poor soil, and endures a great deal of fire. This tree is not the equal of *Pinus Virginiana*²⁾ and inferior in almost every respect to *Pinus echinata*. It is a mistake to encourage the propagation of inferior species, such as the pitch-pine in regions where *P. echinata*, and several other excellent trees grow equally as well. Pitch-pines are of course better than nothing, but when they are mixed with *P. echinata*, as is often the case in Southern New Jersey, the sooner they are cut out the better. In spite of fires and of the great demand for its wood, in early times, for ship construction, owing to its marvellous reproductive ability, the smooth-bark pine has held its own.

In the "Timber Pines of the South", Dr. Chas. Mohr, in the chapter on this species says: "When maintenance of forest, and production of timber under a rational system of forestry is to become the rule, this species above all others, of southerly distribution, will claim attention, for it can be safely asserted, that of the coniferous trees adapted to the climatic conditions

Compart-
ments and
Fire lanes.

Smooth-bark
pine.

¹⁾ Every enterprising farmer should have in the corner of his garden a permanent seedbed. It should be boxed on the sides and ends with wide strong boards and covered with fine poultry netting which should be nailed to a frame so that it can be easily removed. The soil of the bed should be a soft rich sifted loam. Whenever the farmer in his travels finds seeds of trees which are desirable he should sow them in this bed. While the trees are still small he should transplant them to his woodlot. In this way little by little and with the expense of only a little labor he can supply himself with seedlings and gradually improve the condition of his forest.

²⁾ In Central New Jersey on light loamy soil one may often see on the farms pure stands of *Pinus Virginiana* (formerly *inops*). The wood is light and of good quality. As far as I have been able to observe however it is less adapted to dry sandy soil than *Pinus echinata*.

Seedbeds.

Pinus inops
or *Virginiana*
in Central
Jersey.

of the Southern Atlantic forest, no other can be found of better promise, for the production of valuable timber in the shortest time". In another place he says: "Among the coniferous trees of Eastern North America, the short leaf pine stands next to the Long-leaf Pine (*P. palustris*), in importance to the lumber industry, and in the value of its timber. Freer from resinous matter, softer, more easily worked, not less susceptible of a good finish, the lumber of the short-leaf pine, is often preferred by the cabinet maker, and the house carpenter to that of the Long-leaf pine. Less tenacious, and of less power of resistance under strain, it is principally used for the lighter frame work in buildings, for weather-boarding, flooring, ceiling, wain-scoting, cases for windows, and doors, for frames and sashes of all kinds, and for shingles. Most of the dwellings located within the districts where this tree prevails, are built almost entirely of short-leaf pine lumber, which bears ample testimony to its wide usefulness. It is also extensively employed in car-building, for cross-ties, and in the manufacture of furniture." In another place he says, "No other timber tree found in the southern portion of the Atlantic forest region, is more easy of natural reproduction than this, throughout the wide range of its distribution. This is readily accounted for, by its great fecundity, the seeds produced in great abundance almost without failure every year being profusely spread far and wide, and germinating easily whenever the proper soil and a chance are offered for their reception. By their thrifty growth the seedlings soon gain the upper hand over the contemporary growth of other species".

An ideal forest.

One should have no hesitation therefore in recommending the short leaf pine. The finest forest I have ever seen in Southern New Jersey consisted of tall, clean-boled trees of this species with a rich underwood of chestnut oak (*Quercus Prinus*). This forest was of natural formation, and remained untouched by axe and fire for many years.

Seedling forests.

Now and then a beautiful seedling forest, naturally regenerated from adjoining woods may be seen in New Jersey, and as in the Eastern peninsula of Virginia if this species is favored, in the course of time it will be the rule and not the exception. It is not difficult however to secure a good stand by sowing the seed, provided the seed is fresh and fertile. The easiest and cheapest way is to plant the seed mixed with dirt in rows, or in narrow strips across the field four or five feet apart. The best way to prepare this seed bed in case the land is not too stumpy, is to run a narrow one-horse scratch harrow over it, and then, after the seed is sown run the harrow over the same strip again, in order to cover the seed. If one man strikes out the strips with the harrow, while another sows the seed, a large area can be covered in a short time. Where a horse and

Method of sowing.

harrow cannot be used, it is best to work in the seed with a rake. Throughout the south, swine prepare this seed bed. After the seed has been sown, if the soil is very dry and sandy and liable to shift, the strips must be covered with pine chats and brush, on which a little sand may be thrown to hold them down. As soon as the young pines form a closed canopy thinning should begin, and continue throughout the whole period of their life, so that every tree may have sufficient space and light and yet free itself of limbs. The removal of litter and the time of cutting depend entirely upon circumstances. If the owner needs the litter it is proper to remove it; if he wants poles, or small pilings there is nothing to hinder him from cutting his forest in the pole-stage.

Red Cedar (*Juniperus Virginiana*), is an excellent tree for the dry sandy upland. No American tree has a more interesting and instructive oecology¹⁾ It ranges from Cape Cod to Vancouver's Island, from Canada to Florida. In the north it inhabits dry, rocky uplands; in the South, it grows in swamps which are often covered with water; in the rich bottom lands of the Mississippi Valley it is a lofty and noble tree; in the limestone regions of Northern Alabama, it is almost a bush; and along the shores of New Jersey, it is flat-crowned and irregular, but a beautiful, tree in spite of shifting stand and salt-sea breezes. The quality of the wood also depends upon the region in which it grows. In many places it is of little worth, in others it is excellent in quality, strongly aromatic, rich red in color and famous the world over for pencils. It is one of the commonest trees in Southern New Jersey, quickly producing a highly prized wood on soil the surface of which at least is sterile. Its fruits are devoured by birds which scatter its seeds. When growing alone, it is pyramidal in shape, with many branches. Sometimes the twigs and leaves are stiff and prickly, sometimes soft and pendulous. The wood of these knotty trees is extremely beautiful, and the limbs are of use for boat knees, rustic fences²⁾ etc. It is also an excellent wind-break although subject to a fungus disease which infests the apple and quince.

The Red
Cedar.

¹⁾ The basis of sylviculture is oecology or the science of trees in relation to their environment, many of the most important points of which in reference to American species are unknown. Much may be learned of the habits of trees by studying them in regions in which they are not indigenous. More is known of the sylvicultural peculiarities of several American trees in Europe than in America. A careful study of the tropical forest will throw light upon many physiological problems, especially those which have to do with climatic conditions (See *Haberlandts Tropenreise*). It behooves the Americans to emulate the Dutch in Java and the English in India and establish in their new possessions experiment stations, schools, and laboratories where northern students may study plant physiology, the *sine qua non* of agriculture and sylviculture.

Oecology.

²⁾ A cheap and very beautiful rustic fence, in regions where polewood is plentiful, may be constructed without sawing or the use of nails. With a large auger, holes should be bored through the posts, into

A good
fence.

The red cedar should be grown in pure stands and carefully thinned from time to time. The young trees are difficult to transplant in dry sandy soil and the seeds, although abundant and easily collected, rarely germinate evenly. I have been told that nurserymen bury them in a "rot-heap" for two winters, and a summer, and sow them the following Spring. (The same is true of the holly [*Ilex opaca*].) The wood of the cedar even when knotty is in demand for posts, the quality produced in Southern New Jersey is excellent, and there is little land too dry and sandy to support it.

The locust.

Of the hardwood trees, the most valuable for the dry uplands of New Jersey is the *Robinia pseudacacia*.^{1 & 2} In the Region of Bordeaux, where the soil is similar to that of the Coastal Plain of South Jersey, extensive private plantations may be seen. For this purpose, especially on small farms where fencing is an important item, the locust has no equal in spite of the depredations of the borer. In California, I have been told, the borer does not exist, and that in twenty years a locust-tree in the open, attains a diameter of as many inches. It is claimed by some that the injury caused by this insect is less, if other trees are planted with the locust. It is excellent for planting in open places in the forest in the form of hursts, here and there, or as a fringe to pine-plantations especially along rail-roads because it is not inflammable. The locust grows

which the poles or rails ten feet in length or better shorter should be neatly and tightly fitted. This kind of fence is easily constructed, one bent at a time, and is strong and durable. It may be easily torn down and moved without injury to its parts owing to the absence of nails. The posts and rails should be barked and painted with cheap preservatives. The cheapest, but least attractive, material for this purpose is coal-tar. Fences in forests may be made to serve other purposes than protection. For instance if the top rail is squared and strong it may be used as a track for a carrier for the transportation of wood. For a description of M. P. von Coulon's "Monorail" see Swiss Forestry Journal for Oct. 1898; or, if the fence is of wire, the wires may be used for telephonic communication, as on the farms in Australia; or, if in a country where there is no danger of freezing, one rail may be a pipe for the transmission of water, as in California.

The
"Kermes".

¹) One objection to the locust in Europe is that owing to the sharp spines on the young wood it is difficult to gather for fagots.

It is also of interest to note that in certain places it is attacked by the "Kermes" (*Pulvinaria* or *Lecanium vitis*) an insect which is also injurious to the apple and grapevine.

Prunus serotina.

²) Owing to the depredations of the locust borer it is always best to mix another species with the locust. For this purpose *Prunus serotina* and the American chestnut are excellent. The wildcherry (*P. serotina*) is worthy of more encouragement than it has heretofore received. It grows on poor soil, is easily propagated, yields an excellent wood, and attracts birds which are fond of its fruits. Mr. J. H. Schober, the pioneer of heath planting in Holland, who is experimenting with many species of foreign trees on his plantation at Schovenhorst was loud in his praises of this tree and pronounced it one of the most promising of his vast collection.

rapidly on poor soil, produces an extremely useful and durable wood and an ash richer in inorganic constituents than the majority of hardwoods. As, with other leguminous plants, bacteroids, which reside in a symbiotic state, in tubercles on its roots are able in some mysterious way to accumulate nitrogen. The litter which is rich, but thin, quickly decays. Once established, the locust-hurst, will never need renewal, hundreds of stool-shoots and root-suckers are present to take the places of felled trees on the admission of light. Besides a tap-root the locust has an extensive horizontal root system by which the soil is held in place. It is for this reason used on railroad embankments and dry soils subject to shifting. The wood is useful for posts, and other purposes even when young, and is therefore of great value for private planting. Both red cedar and black locust may be sown in the same way that I have indicated for the pine. The seeds of the locust, if planted in the Spring, should be soaked in warm water for three days before planting.

The white cedar (*Chamaecyparis thyoides*), is the choicest of the soft woods of Eastern America. Not even inferior to the famous pumpkin white pine. In fact for boat and tank construction it has no equal. The wood is light, soft, clean, easily seasoned, and remarkable for its durability. It neither warps nor checks under the most trying circumstances. It is extensively used for bridge-plank, shingles, weather boards interior finish, and in the construction of fences either in the form of rails or palings. It has a pleasant cedary aroma, and when exposed to the weather becomes a beautiful steel or lichen grey in color.¹⁾

The White
Cedar.

The white cedar should be grown in the form of a pure crowded wood on wet mucky or wet sandy soil. The canopy should be uninterrupted, and the lower limbs should interlace. If the forest is too thin, irregular, with all age classes and here and there other species, the trees are easily uprooted by the wind owing to the slight hold which they have upon the soft mucky soil. The stand should be so thick and the lower limbs interlace to such an extent that the tree will free itself from branches, produce clean boles and prevent the growth of underbrush. Owing to its sharp, conical top it endures close planting, although regular thinnings are necessary almost throughout the whole period of its life.

In this way, even in America, the forest will yield a small but constant income, since there is some demand for cedar poles.

¹⁾ The bark of the white cedar is tough and fibrous and similar to coir in nature. Many trees of this species in South Jersey have been ruined by the fishermen who use strips of the tough bark on which to string their fish. In Russia the manufacture of mats rope etc. from bark is an important industry and in New Jersey the white cedar bark might be used for similar purposes.

Bark of the
White Cedar.

When sawn in half, barked and soaked in preservatives, these poles, even when very small, are of use in the construction of fences. In spite of the common use of wire, there is still in America great demand for good fence material. These saplings are useful for vine-props, masts for small boats, handles for rakes, boat hooks, and the like, racks for wagons and stalls, flag poles, plaster-laths, fence palings and even shingles. In fact, from the time the tree reaches a diameter of three inches it is useful.

If a cedartree becomes covered with grey lichens, as is often the case, it indicates slow growth, unhealthfulness and unsuitable environment.

The cedar is a great seed producer, even when quite young. The seeds are formed in small cones and are easily collected. A pure stand of cedar may be secured in three ways. If one has a mixed deciduous swamp, with here and there a cedar, as is common, the easiest way to convert it into a pure stand of cedar, is to cut and keep down all trees, except the cedar. These seed-trees, with the admission of light and air will produce an abundance of seed. A stand of cedar produced in this way may be irregular, and uncertain. Perhaps the easiest and quickest way to secure a stand of this tree is to plant it. Young cedars are constantly invading cranberry bogs where they are very unwelcome. These can be easily secured in large numbers, and are better for planting than the spindling specimens from the woods. Another way is to sow the seed. After removing all the trees and brush from the place where a cedar stand is desired, when not too dry, it is best to burn over the surface, and then sow the seed mixed with dirt.

There are many persons in South Jersey who possess small tracts of land out of which they must earn a livelihood. The land has been undergoing such a process of division of late, that the average land holder probably owns little more than a hundred acres. The day of the large farm in New Jersey is past. Owing to its nearness to excellent markets, general farming it being replaced by a more intensive form of agriculture, and old fashioned crops are being replaced by specialties.

Hundreds of uneducated emigrants have invaded the Pines, owing to the cheapness of the soil, and proximity to large cities. Few of these have brought with them European forestry ideas, and many of the most disastrous fires are those which they carelessly set in clearing their farms. Throughout this region there are German, Italian, Russian and other foreign colonies. By thrift and frugality many of these have produced fruitful farms on soil that was formerly waste land, indeed it is claimed that, owing to the warmth of this silicious soil, the fruits are earlier and sweeter. It may be easily worked with one horse and

Securing a
pure stand of
White Cedar.

The small
land-holder.

few implements, at any time when not frozen, and when abundantly fertilized and watered produces a superior grade of fruits and vegetables.

What the small farmers have already accomplished in this region, demonstrates without a doubt, that there are many latent possibilities in the Pine lands of New Jersey, and that location in reference to markets is of more importance than the quality of the soil. Owing to the development of rapid transit and the cheapening of transportation rates, a migration from the cities into the neighboring country has begun. A large proportion of cultivatable land therefore is destined to be cleared and farmed, and to these prospective farmers I would suggest a "forest-farm".

Farming in
South Jersey.

Suppose a person possesses one hundred acres of woodland out of which he wishes to make a combination forest and farm. The first step is to clear a fire lane around the whole of it, at least two hundred feet in width¹). This lane should constitute the cultivated portion of the farm. On this no inflammable crop should be planted.

"Forest-
farms".

Even the sandiest, driest land, when fertilized with the quickly disintegrating pine chats, produces a fine grade of sweet potatoes, which are richer than the white potato, and together with game, fish and berries often constitute the whole food of the natives.

If the one hundred acres referred to, is perfectly square, a firelane two hundred feet wide around it would contain about thirty-five acres, as much as one man can comfortably till. There would be left in the centre a forest containing about sixty-five acres to which the principles of forest management, I have already mentioned may be applied.

If the whole area of woodland in Southern Jersey were treated in this way, sixty five percent would be left in wood, and the whole would be cut up in such a way that extensive fires would be impossible. The sixty-five acres of forest should be divided into about four blocks of fifteen acres each, by lanes or avenues, wide enough to permit a wagon to pass. These lanes should be kept clear of litter during the fire season. If part of the land is swamp bottom the owner is fortunate. He can easily have a white cedar hurst, a cranberry bog, and an osier-holt which will add materially to the profits of his farm.

Owing to the fact that these swamp lands shrink and become lower and damper on being tilled, unless assiduously drained it is better to plant crops which need little or no cultivation, such as the willow, the high-bush blueberry and the cranberry.

¹) An excellent implement for removing small trees in soft soil is a crowbar the larger end of which has been flattened into a sharp chisel. The horizontal roots may be cut first and then the taproot without any digging, the weight of the top of the tree aiding in uprooting it.

An excellent
implement
for clearing
land.

Willow
culture.

Willow culture is destined to become an important industry in this region. The first to begin it on damp pine-barren land was the Baron de Hirsch Colony of Russian refugees.¹ The willow has been rightly called the Cinderella of trees. It will grow on land which for other purposes is almost hopeless. Its pliant twigs are excellent for trunks, boxes, crates, etc. besides baskets. It furnishes work at a season of the year, when there is little else to do. It is a good plan, as is common in Europe, for one member of the family to learn the trade of basket making. In this way, a local industry is produced.

The European willows are superior to those of America and it is very important to plant the kinds adapted to the soil, and suitable for the manufacture of such wares as are most in demand. The almond willow (*Salix amygdalina*), the common Osier (*S. Viminalis*), and the purple willow, (*S. purpurea*) are the species usually recommended.² Every State Agricultural

The Baron de
Hirsch
Colony of
Jews.

Classifica-
tion of osiers
by Oscar
Goesche.

¹) The colony of Russian Jews established by Baron Hirsch in the pinelands of South Jersey is industrious and prosperous. They are capable of working their farms with profit under proper guidance and there is no reason why they should not in time become desirable citizens. The children are taught practical subjects and a few after graduating from their own schools have entered other American agricultural institutions from which they have been graduated with honors.

²) The following classification of the most useful varieties of basket willows is from a pamphlet on willow-culture by Oscar Goeschke of Bern:

I. Almond-leaved willows.

1. *Salix amygdalina fusca*, Brown almond willow.
2. *S. amygdalina viridis*, Green almond willow.
3. *S. amygdalina vitellina*, Yellow almond willow.
4. *S. amygdalina praecox*, Early almond willow. These thrive in almost every soil which is not too dry and demand close planting.

II. Copse-willow.

5. *S. polyphylla*, Green copse willow. Demands rich sandy meadow soil.

III. Stone or purple willows.

6. *S. purpurea emendata*, noble purple willow.
7. *S. purpurea Helix*, Green stone willow.
8. *S. purpurea Kerksii*, English stone willow.
9. *S. purpurea glaucescens*, Blue green stone willow.
10. *S. purpurea Uralensis*, Common Ural willow. Grow well on poor soil which is not too dry.

IV. Blend willows.

11. *Salix rubra augustifolia*. Long blend willow. Is one of the choicest sorts.

V. Blood willows.

12. *S. pulchra*, Caspican blood willow.
13. *S. pulchra ruberrima*, Darkred blood willow. Are of the first quality and thrive even in sandy and dry soil.

VI. Hemp willows.

14. *S. viminalis regalis*, Yellow queen willow.
15. *S. viminalis cinnamomea*, Common brown hemp willow.
16. *S. viminalis aequalis*, Uniform leaved hemp willow.
17. *S. viminalis alopecuroides*, Fox-tail willow. These are the queens of willows, desiring damp humus earth or rich cultivated fields.

VII. Ash willows.

18. *Salix Seringeana*, Dutch ash willow. This species is exceeded in the quality of its wood but not in yield, durability or slightrness of demands.

Experiment Station, or the United States Agricultural Department should establish a *Salicetum*, in order to supply the proper kinds, because it is difficult, if not impossible to secure them true and pure, from nurserymen.

In addition to these industries, if progressive, the owner of the "forest-farm" could keep both bees and poultry with profit, even in the most remote and barren part of this whole region.

Apiculture, although it requires considerable skill in manipulation, should be a subsidiary forest occupation. This has been strongly recommended to the forestry people throughout Europe, who have their homes in the forest. In South Jersey there is abundant bee pasturage. The locust, the linden, the catalpa, the chestnut, the red maple, the hazel, laurel, huckle and blue berries, grape vines, willows, holly, persimmon, magnolia and a host of other plants, yield honey, or pollen. From pollen, bee bread is manufactured on which the larvae are fed. From buds etc., the bees collect a viscid glue, or propolis, with which they strengthen their cells, and fill up the cracks in their hives, as a protection against cold.

Apiculture.

In order to secure a fine type of bee, it is necessary to supplant the native queen with one of a better variety, either Italian or Carniolan.⁴

Besides gathering large quantities of honey, bees materially increase the fruit and seed crops, by fertilizing the flowers.

Poultry raising is also an important subsidiary occupation. In the dry soil, and mild climate of the pines, chickens and turkeys, and along the rivers waterfowl, thrive securing throughout a large portion of the year their own livelihood, and at the same time do incalculable service to the forest farmer in restraining insects.

Poultry raising.

Property owners should positively prevent all hunters with dog and gun, from roaming at will through their woods. Many men would be willing to pay well for the exclusive hunting right of even a small tract of land.

Hunting.

¹ The domestic bee in America (*Apis mellifica*) was introduced by early settlers from Europe. They have multiplied and become common. The Cyprian race from the Island of Cyprus has produced the largest yield of honey on record for a single colony in America that is, one thousand pounds in one season. They are the most assiduous of bees but are very sensitive and require great care in manipulation. The Italian variety is also famous and easier to handle. The gentlest of bees, however, is the gray race of the Mountains of Carniola (Krain, near the Adriatic) in Austria. This bee is steadily growing in favor in America. See "The Honey Bee" by Frank Benton, publication of the U. S. Dept. of Agriculture.

The bee of America.

It is in short, through a combination of many of these industries, which are minor only in name, that forestry and farming may become profitable on soil which is not naturally fertile.

State Ex-
perimental
Forest
Farms.

In no way could the State better further forestry and agriculture than by establishing experimental farms of this sort, in order to demonstrate their practicability, and to encourage and instruct those who only need object lessons and hints in order to establish for themselves similar plantations. The Forestry Division of the Federal Government has recently taken a praiseworthy step in specially offering to help as far as possible all private woodlandowners.

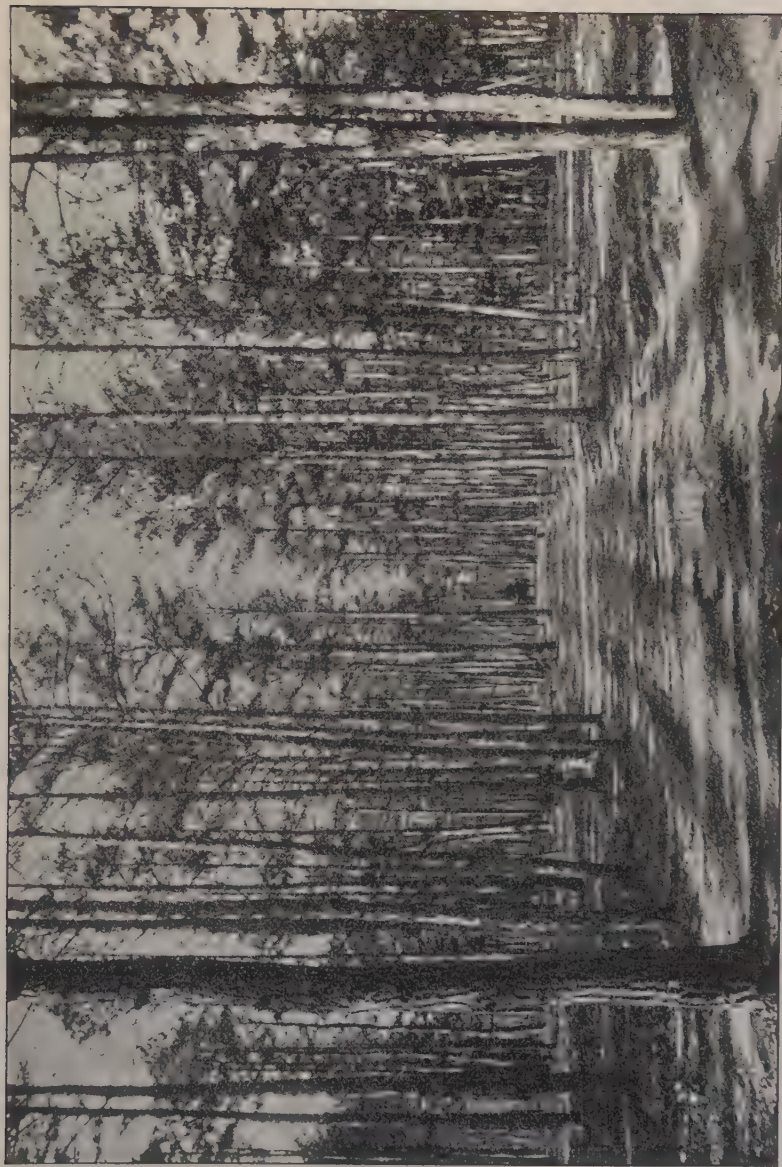


Plate V. The Pines at Lakewood from which the litter and brush have been removed in order to prevent fire.

Concluding Remarks.

Volumes could be written on what has been done on sandy lands in Europe. The stereotyped examples are the Dunes and Landes of Gascony and the Geest and Sandlands of Northwestern Europe.

Prior to 1785 the Dunes and Landes of Gascony were unhealthy, unproductive and practically uninhabitable. This condition of affairs was produced by the destruction of forests. It is an old story how the sand dunes along the shore moved inland covered villages and occluded inlets. The interior, called the Landes, became a pestilential swamp. The primitive natives standing on stilts watched their flocks which fed upon the coarse and scanty herbage. Today this region is a health resort. It is covered with pines and is prosperous. Although a few severe fires¹ occur now and then and owing to a lack of roads or other sufficient means of transportation all the wood is not sold, nowhere in the world however are the following industries more extensively and scientifically developed: Collection and manufacture of naval stores, the impregnation of wood with preservatives and ostreiculture. They have also demonstrated that there is no better way of fixing shifting sands, of draining swamps and removing pestilence than by forest planting.²

The Landes
and Dunes
of Gascony.

Destroy completely the forest which covers the Coastal Plain of Eastern America and it will become a bed of shifting barren sand, in places swampy pestilential, unproductive, unsightly and unfit for habitation although capable of producing under forest management an abundance of excellent timber and naval stores forever.

The
destruction
of forests
causes un-
healthfulness

Large areas of the Coastal Plain of America are rapidly approaching the former condition of the Landes of Gascony.

¹) After several fires in the Montagne Noir comes the announcement of fire in the Landes, spreading from the region of Laborheyre and Parentis-en-Born to Mimizan over thousands of hectares of pinelands. An innocent man amused himself burning the herbage in the midst of a country terrified by the heat of dog days near forests of pine. Hatred and illwill incited criminal hands to imitate this example. The fire traversed thousands of hectares of forest, as in America, destroying everything in its way. It is astonishing, considering the slight attention accorded to the laws or restrictive regulations, that such disasters should not have occurred earlier during the great heat of August. At last it rains!

Fire in the
Landes.

Revue des Eaux et Forêts. September 1898.

²) Many people believe that a resinous atmosphere is not conducive to malaria and it is said that the Greeks put resin in their resinata wines as a preventive against such fevers.

Resin and
Malaria.

The Atlantic Coast has too many advantages geographically, commercially and otherwise to be allowed to become desolate and unhealthy. It is high time that the slipshod, ruinous methods of today give way to intensive forms of silviculture and agriculture. The trend of migration is southward along the coast. Interests have been centering farther southward every year. The improvements in the Dismal Swamp canal will aid in draining vast areas and in developing lands which have been heretofore infested with malaria. There is little danger of having too much forest in this accessible and otherwise naturally favored region. If only the increment is cut and the naval stores industry scientifically and judiciously conducted by every body the demand will always equal the supply. What a glorious prospect it would be if the Eastern Coast of the United States possessed regulated forests beginning with the white pine and spruce in boreal regions, through forests of the smoothbarkpine, the white cedar, the longleafpine and the Cuban pine in austral regions even to Pinar del Rio and the Isle of Pines in the Tropics!¹

The Eastern Coast of America under proper management is, in this respect at least, capable of almost limitless prospects. The timber of the shortleaf, longleaf and Cuban pines even reaches Germany the home of forestry. Besides there is and perhaps always will be more wood used per capita in America than elsewhere in the world.

The example of the Landes is more applicable to regions south of the Chesapeake than to Southern New Jersey. In the Plains of Northwestern Europe however there are regions which have passed through the same kind of vicissitudes to which the Jersey pinelands are being at present subjected.

In parts of the Plain of Northwestern Europe under the peat have been found pine stumps and the stone implements of the aborigines. Another page in its history is illustrated by oak stumps among which have been found bronze axes and other implements. The third stage in its history which still lingers is represented by the shepherd tending his „snucken” or little black sheep on the broad treeless heath-covered plains. Another stage is well under way. Reforestation, the only salvation for such regions, is destined in time to render it fertile and productive, not of sheep or cabbages, but of an ever-improving quality of timber. The shepherd with his sheep

The Plain of
North-
western
Europe.

The Cuban-
Pine.

¹) According to Dr. Mohr, the Cuban pine (*P. heterophylla* formerly *Cubensis*) as a timber tree is little inferior to the Longleaf (*P. palustris*). It reproduces itself much more rapidly and will in time probably become the main source of naval stores for the future. It reminds one in some respects of *P. maritima* of France. As already indicated in a previous note this tree is called “she or bastard pine” and in value has been very much underrated. It is common in Western Cuba and the Isle of Pines and I have seen magnificent forests of the same or a closely related form in the mountains of Spanish Honduras.

wandering over broad areas of land is a picturesque but out-of-date relic of the pastoral nomadic stage of human development. Sheep and goats fed in this way have no place in modern intensive agriculture. Land treated in this way in fact soon reaches a stage where even sheep and goats cannot secure a livelihood.

The Sheep
Industry.

Very different in nature and effects from the "snucken" or little black sheep of the Lüneburger Heaths are the little black bees which fertilize the flowers in exchange for the nectar and pollen which they collect. One is often surprised to see a man alone on the heaths surrounded by many hives. He has come perhaps a long distance to find fresh pastures for his bees,

The bee-
Industry.

One of the most attractive regions of the Low Countries is in the lee of the Dutch Dunes. Next to the Landes of France nothing has impressed me more than the beech forests, villas and gardens which are located there in the midst of sand and mud. Numerous instances may be cited to show that the reckless waste of the forest on certain soils is suicidal and that it requires time money and patience to correct evils which could have been easily prevented. In the words of the natives of Perigord „One must sow acorns to reap truffles.”

In conclusion I have yet a few words to say in reference to another side of the subject which has not been sufficiently ventilated. The destruction of vast areas of forest without regard to the future has a deleterious sociological effect upon the standard of life and character of the people of such regions. In South Jersey for instance owing to the exhaustion of saw-stuff there are many deserted hamlets and silent sawmills. It is true that on the whole the population is on the increase but this is due to another class who have come from elsewhere with other abilities and other objects in view. Many of the natives however who were born and bred in the forest and earned their livelihood in the woods have been forced to leave for other regions and engage at a disadvantage in other work. The few who have remained of this class are in a state of stagnation and in many instances were it not for the berry crop and the game in the woods would die of starvation. Owing to the fact that they are idle a large part of the year, that they are far from neighbors except of their own class, that they are often insufficiently fed and clothed there is little wonder that many are outlaws. If a healthy man is busy and earns a fair recompense in an occupation with which he is familiar there are no reasons why he should have any desire whatever to transgress just laws. Of course there are exceptions. I can easily see however why such people would not hesitate to set fire to woods in order to improve the berry crop upon which they are dependant. A large landholder in South Jersey a few years ago instructed his manager to hire help in the extinguishment of fires on his premises. Men were always ready to help fight the fires which

instead of decreasing under the circumstances increased at an alarming rate. The natives were firing the woods to provide themselves with work. It is easy to see how hardpressed penniless people in a devastated forest country would be guilty of such a trick. The backwoodsman without work in the man who sells his vote. The common schools of America are endeavoring to educate such people but much of the good influence is offset by the industrial depression which follows the wasteful destruction of wood in a country where the majority of the people are woodmen.¹

¹) Just as reckless deforestation inevitably leads to idleness want and moral degeneration among those dependent upon the woods so does afforestation have the opposite effect in the same if not greater proportion. In the Landes for instance before the planting of forests a man could buy land enough for a large farm for twenty-five francs. It required over two acres to support one sheep. In less than a century the population sextupled while the population of a large part, of the rest of the country either remained stationary or decreased. A few miserable shepherds were replaced by wood workers, resin collectors, workers in establishments for refining the product and for impregnating wood etc, besides those who were attracted to do other business produced by the change of conditions, also even pleasure and health seekers.
